A BRIEF HISTORY OF EPIDEMIC AND PESTILENTIAL DISEASES,

WITH THE

PRINCIPAL PHENOMENA OF THE PHYSICAL WORLD,

WHICH PRECEDE AND ACCOMPANY THEM,

AND OBSERVATIONS DEDUCED FROM THE FACTS STATED.

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SECTION XV.

Of the Phenomena which attend peſtilential Periods, with Conjectures concerning the Cauſes - 120

SECTION XVI.

Of Contagion and Infection - - 212

SECTION XVII.

Of the Means of preventing or mitigating Peſtilential Diſeaſes - - - 343

SECTION XVIII.

Of the Diſappearance of the Plague in ſome Parts of Europe, and of new Diſeaſes - 412

CONCLUSION.

Addreſſed to the learned Societies in America, Europe, and Aſia - - - 443

ADDENDA.

Of the Lunar Influence - - 454

On Electricity - - - 491

A BRIEF

A BRIEF

HISTORY

OF

EPIDEMIC AND PESTILENTIAL DISEASES.

SECTION IX.

Bills of Mortality for the two last Centuries, with the principal Phenomena of the Elements.

OUR accounts of diseases and the phenomena of the world, which appear to be connected with them, are altogether imperfect. But in the two last centuries we have a tolerable history of diseases, and occasionally an account of the seasons and remarkable occurrences. In the following tables the reader will find the Bills of Mortality for London, Augsburg, Dresden, Boston, one church in Philadelphia, with the bills of a few years for Paris and Dublin; to which are prefixed such of the remarkable phe-

nomena of the elements as I have been able to collect.

As winter makes a part of two years, the word *severe* is set against the year in which the winter began. Thus against the year 1607, the word *severe* refers to the winter of 1607—8. The blanks denote either that nothing singular occurred in those years, or that I have no account of the occurrences. Further enquiries might probably enable me to fill many of those blanks.

Bills of Mortality do not exhibit a complete view of epidemics, as some of the most remarkable, especially influenza, destroy but few lives; and the bills of the years when that disease alone prevailed are remarkably low. It is often the immediate precursor, in spring, of pestilential diseases in autumn, in which cases the bills of the year are very high.

A.D.	Seasons.		Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.			Burials in Augsburg.
	Summer.	Winter.				By common Diseases.	By the Plague.	Total.	
1600	—	—	—	—	Pestilence general — —	—	—	—	1775
1601	Very dry	Severe	—	South America	Plague in Portugal, and many places	—	—	—	1570
1602	Cool & dry	Cold	—	—	Influenza, plague — —	—	—	—	1567
1603	—	—	—	—	Plague in London, and general famine	5773	36269	40042	1488
1604	—	—	Comet	South America	— — —	4323	896	5219	1298
1605	—	—	—	—	— — —	5948	444	6392	1361
1606	—	—	—	—	— — —	5796	2124	7920	1371
1607	Hot	Severe	Comet	Etna —	Plague in Cork — —	5670	2352	8022	2595
1608	Hot	—	—	—	Plague in Cork; dysentery —	6758	2262	9020	2476
1609	—	Severe	Comet	Etna —	Plague in Denmark — —	7554	4240	11784	1469
1610	Very dry	—	—	—	Influenza in Europe; anginas in Spain	7486	1803	9289	1941
1611	—	—	—	—	Plague in Constantinople —	6716	627	7343	1891
1612	Very dry	—	Comet	—	Fevers — — —	7778	64	7852	1625
1613	—	—	—	—	Plague in Constantinople —	7503	16	7519	1701
1614	—	Severe	—	Etna —	Fatal small-pox in Europe; measles in Persia	7367	22	7389	1444
1615	Cool	—	—	—	— — —	7850	37	7887	1771
1616	Hot & dry, England	—	—	—	— — —	8063	9	8072	1631
1617	Hot & dry, England	—	—	—	— — —	8280	6	8286	1514
1618	—	—	Comets	—	Pestilence among the Indians in America; fatal anginas in Naples —	9596	18	9614	1354
1619	—	—	—	Iceland —	Pestilential fevers in France —	8000	9	8009	1485

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com. Diseases.	Burials in London. By the Plague.	Burials in London. Total.	Burials in Augs.	Burials in Dresn.
1620	—	Cold	Comet	— —	Fevers —	9691	21	9712	1667	—
1621	—	—	—	— —	Small-pox — —	8112	11	8123	1517	—
1622	Dry, Am.	—	Comet	— —	Malignant fevers, precursors of plague	9420	16	9436	1959	—
1623	—	—	—	— —	Malignant fevers, as above —	11095	17	11112	1875	421
1624	—	—	—	— —	Malignant fevers, &c. —	12199	11	12210	1370	411
1625	—	—	Comet	Iceland and Canaries	Plague in London, Denmark and Italy, Holland, &c. —	18848	35417	54265	1392	481
1626	Hot	—	—	— —	Plague in Lyons, Wirtemberg, &c.	7400	134	7534	1440	740
1627	—	—	—	— —	Plague in France, &c. —	7713	4	7717	2494	412
1628	—	—	—	— —	Plague in France, Augsburgh, &c.	7740	3	7743	5611	—
1629	—	—	—	— —	Plague in Amsterdam, &c. —	8771	—	8771	1265	398
1630	—	—	—	— —	Plague in Vienna; in Cambridge, England	9228	1317	9545	909	480
1631	—	—	—	Vesuvius —	Erysipélas, diseases in the throat —	8288	274	8562	859	844
1632	—	—	—	Vesuvius —	Eruptive fevers; pestilence in Dresden, Augsburgh, &c. — —	9527	8	9535	3485	3129
1633	Hot	Severe, Eu	Comet	Etna —	Plague in Dresden, &c.—Pestilence in America — — —	8392	—	8392	3364	4585
1634	Hot	Severe Am.	—	Etna —	Plague in Ratisbon; pestilential fevers in London; precursors of the plague	10899	1	10900	4664	721
1635	—	Mild	—	Vesuvius and Etna	Plague in Augsburgh, Leyden, Mentz, &c.; pestilential fevers in London —	10651	—	10651	6243	597
1636	—	—	—	Etna and Heckla	Plague in London, Nimeguen, Rome, &c.	12959	10400	23359	790	594
1637	Hot, Eng.	Severe	—	— —	Plague in Holland, Denmark, &c.	8681	3082	11763	823	1897
1638	Hot & dry	—	—	— —	Sickness in America; small-pox and fevers in Europe — —	13261	363	13624	638	531
1639	Dry, Am.	—	—	— —	— —	9548	314	9862	674	1845

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com. Diseases.	Burials in London. By the Plague.	Burials in London. Total.	Burials in Augsb.	Burials in Dresd.
1640	—	Sever Eu.	—	—	— — —	11321	1450	12771	586	935
1641	—	Severe Am	—	—	— — —	11767	1375	13142	587	525
1642	—	—	—	—	— — —	11999	1274	13273	593	601
1643	Hot & dry	—	—	Etna and Vesuvius	— — —	12216	996	13212	638	1041
1644	—	—	—	—	— — —	9441	1492	11933	659	459
1645	Hot, Eng.	—	—	—	Sickness among the Indians in America	9608	1871	11479	758	528
1646	—	—	—	—	Plague increafed in London —	10415	2365	12780	1488	481
1647	Hot, Am.	—	Comet	—	Increafe of plague in London; influenza and peftilential fever in America	10462	3597	14059	1358	471
1648	—	—	—	—	Plague in Ireland; malignant fevers in Italy, France, and Spain	9283	611	9894	1208	606
1649	—	—	—	—	Plague in Spain; small-pox in Boston	10499	67	10566	940	597
1650	—	—	—	Etna —	Plague in Cork; influenza in Europe	8749	15	8764	533	494
1651	Hot	—	—	—	Quinsey in Italy — —	10444	23	10467	577	511
1652	Dry, Eng.	—	Comet	—	Fevers — — —	12588	16	12604	616	450
1653	Dry, Eng.	—	—	—	Sicknefs in New England —	10081	6	10087	575	535
1654	—	Severe	—	—	Plague in Denmark, Turkey, Chester in England, &c.	13231	16	13247	764	558
1655	Dry, Eng.	—	—	Vesuvius	Plague general in Europe; influenza in America — —	11368	9	11377	570	515
1656	Hot	—	—	—	Plague in Italy, &c. —	13915	6	13921	641	560
1657	Hot	Severe	—	—	Plague in Genoa — —	12430	4	12434	731	663
1658	Wet, Am.	—	—	—	Influenza in Europe; sicknefs in America	14979	14	14993	731	518
1659	—	—	—	—	Cynanche trachealis in America	14720	36	14756	831	599

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com Diseases.	Burials in London. By the Plague	Burials in London. Total.	Burials in Augs.	Burials in Dresd.
1660	—	—	—	Iceland & Vesuvius	Measles in England — —	15104	14	15118	657	542
1661	—	—	Comet	—	Measles; tertians severe in London for four years — — —	19791	20	19811	668	649
1662	Dry, Am.	—	—	—	Sickness in America —	16542	12	16554	788	637
1663	—	Mild	—	—	Fevers; diseases among cattle; plague in Holland — —	15347	9	15356	836	620
1664	Wet	Severe	Comet	Etna	Purple fevers in Prussia; corn first mildewed in America — —	18291	6	18297	761	662
1665	—	—	Comet	Etna	Plague in London and over Europe	28710	68596	97306	745	699
1666	Hot and dry	—	Comet	Etna	Dysentery over Europe; small-pox in Boston	10840	1998	12838	737	824
1667	—	—	—	Etna	Fevers — — —	15841	36	15877	769	823
1668	Hot	Severe	Comet	Etna	Pestilence in New York; small-pox in Europe	Plague in London ceased.		17294	711	703
1669	Hot	Severe	—	Etna, great	Dysentery, fevers, measles, in Europe; cat plague in Westphalia —			19436	743	794
1670	—	—	—	Etna	Measles in London; small-pox			20198	734	776
1671	—	—	—	Etna	— — —			15729	733	743
1672	—	Cold	Comet	Etna	Measles and small-pox —			18230	768	909
1673	Cold, Eng.	—	—	Etna	Catarrhs — — —			17504	751	909
1674	—	—	—	Etna	Measles and small-pox —			21201	844	846
1675	Wet & cool, Eng.	Severe	Meteor	Etna	Influenza in Europe — —			17244	913	947
1676	—	—	Meteor	Etna	Measles and small-pox —			18732	913	1284
1677	—	—	Comet	Etna	Small-pox in Charlestown, in Massachusetts; dysentery in Denmark —			19067	934	887
1678	Dry and hot	—	Comet	Etna	Severe plague on the Barbary Coast; small-pox in Boston and in South America			20678	943	1020

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Burials in Augsb.	Burials in Dresden.
1679	—	Severe	Comet	Etna	Catarrh in Europe; plague in Vienna	21730	945	975
1680	Hot and dry	Severe	Comet	—	Plague in Dresden; coughs, dysentery	21053	976	6414
1681	Very dry	—	—	—	— — —	23971	860	753
1682	—	—	Comet	Etna and Vesuvius	— — —	20691	734	1023
1683	—	Very severe	Comet	—	Plague at Halle; spotted fever in Dublin; murrain among cattle	20587	808	1200
1684	Hot and dry, Eng.	Cold in Eng.	—	—	Malignant dysentery over Europe	23202	858	1154
1685	Hot and dry, Eng.	—	—	—	— — —	23222	848	937
1686	Dry, Italy	—	Comet	Etna and a meteor	— — —	22609	981	1199
1687	Rainy, Europe	—	—	—	— — —	21460	855	927
1688	—	Severe	—	Vesuvius	Influenza in Europe	22921	860	1011
1689	Rainy, Autumn	—	Comet	Etna and Vesuvius	Small-pox in Boston; spotted fever in Germany — —	23502	806	1163
1690	Rainy	Severe	—	—	Corn mildewed —	21461	1071	1200
1691	Hot and dry	—	—	—	Corn blasted; diseases among cattle; spotted fever in Europe —	22691	785	11[illegible]
1692	Hot	—	—	Etna	Malignant fevers in Europe —	20874	935	999
1693	—	Cold, Europe	—	Etna and Iceland	Influenza in Europe —	20959	1084	1071
1694	Hot	—	—	Vesuvius and Banda	Malignant fevers — —	24100	1106	1426
1695	Rainy, Europe	—	—	—	Apoplexies in Italy; measles and chin-cough in Europe; sickness in America	19047	1048	1227
1696	Cold & wet, Eng.	—	—	—	Dysentery among children; spotted fevers	18638	927	1055
1697	—	Severe	—	—	Spotted fevers in Europe; Influenza in America began — —	20970	777	1070
1698	—	Severe	Comet	South America	Influenza in America; spotted-fever in Europe; malignant pluerisy in America	20183	877	919
1699	Hot, America	—	Comet	—	Influenza in Europe; plague in Philadelphia and Charlestown, and Levant	20795	940	1139
1700	—	Mild	—	—	Sore throat in Levant; catarrhs and measles in Europe —	19443	786	1198

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com Diseases.	Burials in London. By the Plague	Burials in London. Total.	Burials in Augs.	Burials in Dresd.
1660	—	—	—	Iceland & Vesuvius	Measles in England — —	15104	14	15118	657	542
1661	—	—	Comet	—	Measles, tertians severe in London for four years — — —	19791	20	19811	668	649
1662	Dry, Am.	—	—	—	Sickness in America —	16542	12	16554	788	637
1663	—	Mild	—	—	Fevers; diseases among cattle; plague in Holland — —	15347	9	15356	836	620
1664	Wet	Severe	Comet	Etna	Purple fevers in Prussia; corn first mildewed in America — —	18291	6	18297	761	662
1665	—	—	Comet	Etna	Plague in London and over Europe	28710	68596	97306	745	699
1666	Hot and dry	—	Comet	Etna	Dysentery over Europe; small-pox in Boston	10840	1998	12838	737	824
1667	—	—	—	Etna	Fevers — — —	15841	36	15877	769	823
1668	Hot	Severe	Comet	Etna	Pestilence in New York; small-pox in Europe	Plague in London ceased.		17294	711	703
1669	Hot	Severe	—	Etna, great	Dysentery, fevers, measles, in Europe; cat plague in Westphalia —			19436	743	794
1670	—	—	—	Etna	Measles in London; small-pox			20198	734	776
1671	—	—	—	Etna	— — —			15729	733	743
1672	—	Cold	Comet	Etna	Measles and small-pox —			18230	768	909
1673	Cold, Eng.	—	—	Etna	Catarrhs — — —			17504	751	909
1674	—	—	—	Etna	Measles and small-pox —			21201	842	846
1675	Wet & cool, Eng.	Severe	Meteor	Etna	Influenza in Europe — —			17244	913	947
1676	—	—	Meteor	Etna	Measles and small-pox —			18732	913	1184
1677	—	—	Comet	Etna	Small-pox in Charlestown, in Massachusetts; dysentery in Denmark —			19067	934	887
1678	Dry and hot	—	Comet	Etna	Severe plague on the Barbary Coast; small-pox in Boston and in South America			20678	943	1020

A. D.	Seasons.		Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in		
	Summer.	Winter.				London.	Augsb.	Dresden.
1679	—	Severe	Comet	Etna	Catarrh in Europe; plague in Vienna	21730	945	975
1680	Hot and dry	Severe	Comet	—	Plague in Dresden; coughs, dysentery	21053	976	6414
1681	Very dry	—	—	—	— — —	23971	860	753
1682	—	—	Comet	Etna and Vesuvius	— — —	20691	734	1023
1683	—	Very severe	Comet	—	Plague at Halle; spotted fever in Dublin; murrain among cattle	20587	808	1200
1684	Hot and dry, Eng.	Cold in Eng.	—	—	Malignant dysentery over Europe	23202	858	1154
1685	Hot and dry, Eng.	—	—	—	— — —	23222	848	937
1686	Dry, Italy	—	Comet	Etna and a meteor	— — —	22609	981	1199
1687	Rainy, Europe	—	—	—	— — —	21460	855	927
1688	—	Severe	—	Vesuvius	Influenza in Europe	22921	860	1011
1689	Rainy, Autumn	—	Comet	Etna and Vesuvius	Small-pox in Boston; spotted fever in Germany — —	23502	806	1163
1690	Rainy	Severe	—	—	Corn mildewed —	21461	1071	1200
1691	Hot and dry	—	—	—	Corn blasted; diseases among cattle; spotted fever in Europe —	22691	785	[illegible]
1692	Hot	—	—	Etna	Malignant fevers in Europe —	20874	935	999
1693	—	Cold, Europe	—	Etna and Iceland	Influenza in Europe —	20959	1084	1073
1694	Hot	—	—	Vesuvius and Banda	Malignant fevers — —	24100	1106	1426
1695	Rainy, Europe	—	—	—	Apoplexies in Italy; measles and chin-cough in Europe; sickness in America	19047	1048	1227
1696	Cold & wet, Eng.	—	—	—	Dysentery among children; spotted fevers	18638	927	1055
1697	—	Severe	—	—	Spotted fevers in Europe; Influenza in America began — —	20970	777	1070
1698	—	Severe	Comet	South America	Influenza in America; spotted-fever in Europe; malignant pluerisy in America	20183	877	919
1699	Hot, America	—	Comet	—	Influenza in Europe; plague in Philadelphia and Charlestown, and Levant	20795	940	1139
1700	—	Mild	—	—	Sore throat in Levant; catarrhs and measles in Europe —	19443	786	1198

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Burials in Augsb.	Burials in Dresden.	Burials in Be[redacted]
1701	Hot and dry	—	—	Vesuvius	Plague in the East —	24071	906	992	146
1702	Hot and dry	—	Comet	Etna	Plague in Poland and in New York; small pox in Boston —	19451	900	946	441
1703	—	—	—	—	Plague in Poland — —	20720	1245	1078	159
1704	Dry, Europe	—	—	Ves.&Teneffe.	Plague in Poland and Hungary	22684	1313	964	220
1705	—	—	—	—	Plague in Russia —	22097	748	1346	282
1706	Hot & dry, Eng.	—	Comet	—	Coughs and dysentery among children	19847	842	1098	261
1707	Very hot	—	Comet	Vesuvius	Measles in England —	21600	805	1523	[illegible]
1708	—	Very severe	—	Meteor	Catarrh began in Europe; plague in Thorn	21291	908	1119	298
1709	—	—	—	—	Catarrh, epidemic, plague in Dantzick; apoplexies —	21800	805	1340	377
1710	—	—	—	—	Plague in Lithuania; catarrhous fevers in England and Holland —	24620	811	1414	495
1711	—	Cold, Europe	—	—	Plague in Copenhagen, and among cattle terrible —	19833	855	1221	363
1712	Wet, England	—	Comet	Vesuvius	Catarrh in Europe; plague in the East	21198	894	1140	316
1713	Wet, England	Mild	—	—	Measles in America; plague in Austria	21057	860	1383	450
1714	Dry and hot, Eng	—	—	—	— — —	26569	948	1250	413
1715	Dry, England	—	—	—	Small-pox and measles in England	22232	1024	1353	336
1716	Very dry, Eng.	Severe	—	—	— — —	24436	905	1274	355
1717	—	Great snow in Am.	Comet	Vesuvius	Catarrhs in Europe —	23446	988	1908	451
1718	Hot & wet, Eng.	—	Comet	—	Malignant fevers; plague in Turkey	26523	768	1412	380
1719	—	—	Comet Meteor	—	Plague in Levant; pestilential fevers, malignant pleurisy in America	28347	997	—	304

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London	Burials in Dublin.	Burials in Dresden.	Burials in Boston.	Burials in Xst.-Ch. & St. Peter's, Philadel.
1720	Dry, Europe	—	—	—	Plague in Levant, and in Marseilles; malignant fever in America	25454	—	1733	329	—
1721	—	—	—	Iceland	Small-pox in Boston	26142	—	1850	1104	—
1722	Cold & wet, Eng.	—	—	—	Measles in England	25750	—	1519	273	—
1723	—	Cold	Comet	—	Small-pox in England, and plague in Barbadoes	29197	—	1654	413	—
1724	Wet, England	—	—	—	Hooping-cough in England	25952	—	1761	407	—
1725	Wet, England	—	—	Two in Iceland	—	25523	—	1642	324	—
1726	—	—	—	—	Plague in Egypt	29647	2763	—	343	69
1727	Very hot, Am.	—	Comet	Vesu. & Iceland	Sickness in America	28418	2946	—	479	130
1728	Hot, Am.	—	—	Iceland	Plague in Egypt, and in Carolina	27810	—	—	498	86
1729	—	—	Comet	Iceland	Epidemic catarrh in Europe; plague in Aleppo; measles and malignant pleurisy in America	29722	3206	—	570	88
1730	—	Severe Eu.	—	Vesu. & Iceland	Small-pox in Boston; pestilential fevers in South America	26761	2184	—	909	81
1731	—	—	—	—	Small-pox in New York; anginas in Holland	25262	—	—	408	166
1732	—	Severe Am.	Comet	—	Plague in Syria, and Charlestown, S. Carolina	23358	2534	—	499	97
1733	Dry, England	—	—	—	Universal catarrh; plague in Aleppo	29233	2608	—	458	103
1734	—	—	—	—	Scarlatina in Edinburgh; small-pox and fevers in Europe	26062	2466	—	528	116
1735	Wet	—	—	—	Sore-throat in America; measles, coughs, catarrhs, fevers, hydrophobia, in Europe	23538	2196	—	455	96
1736	Wet, Am.	—	—	—	Sore-throat in America and France; measles in England; dreadful plague in Egypt	27581	2101	—	617	144
1737	—	Very sev. Am.	Comet	Vesuvius	Severe catarrh universal; diseases among horses	27823	—	—	607	112
1738	—	—	—	—	Measles in America; pestilence in Barbadoes, New Spain, Oczakow	25825	2506	—	576	107
1739	Wet, England	Very sev. Eu.	Comet	—	Pestilence in Charlestown; measles in Amer.	25432	2201	—	554	97

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Burials in Dublin.	Burials in Boston.	Burials in Xst. Ch. & St. Peter's, Philadel.
1740	—	In Am. very severe	—	—	Measles in America; hooping cough and spotted feves in England	30811	—	704	98
1741	—	—	—	—	Pestilence in Philadelphia and Virginia; spotted fever in England	32169	2790	555	162
1742	—	Severe, Syria	Comet	—	Sore-throat in America and England; plague in Syria, &c.	27483	2320	517	123
1743	Hot —	—	Comet	South America	Plague in Syria, Messina, New York, &c. catarrh in Europe	25200	2193	600	116
1744	—	—	—	—	Influenza in Europe —	20606	1705	497	114
1745	—	—	—	—	Plague in Egypt; fevers and dysentery in America	21296	—	780	125
1746	—	—	—	South America	Fever at Albany; dysentery in Switzerland	28157	1957	578	186
1747	Hot and dry	Severe —	—	Etna	Pestilence at Philadelphia; anginas in England; catarrh in Europe	25494	—	777	192
1748	Dry —	—	—	—	Pestilence in Charlestown; long fever in America; anginas in England	23869	1530	740	175
1749	Very dry, America	—	—	—	Dysentery in Europe and America; long fever; anginas in England	25516	1819	677	128
1750	Very hot, America	Very fevere	Comet	—	Dysentery and anginas in America and Europe; plague on the Barbary Coast	23727	2088	604	125
1751	Wet, England	Severe —	—	Vesuvius	Dysentery and anginas in America; plague in Turkey	21028	—	624	144
1752	Very hot, America	—	—	—	Small-pox in Boston; dysentery and anginas in America and Ireland	20485	1844	1009	129
1753	—	Severe —	—	—	Dysentery and anginas in America	19276	1825	481	105
1754	—	Mild in America	—	Vesuvius	Gangrenous sore-throat in England, Ireland, and America	22696	1897	434	94
1755	—	Severe, Europe	—	Etna	Influenza in Europe; anginas in Europe and America; plague in Turkey	21917	2002	484	99
1756	—	Severe, Syria	Comet	Iceland	Influenza in America began	20872	1550	526	215
1757	—	—	—	—	Influenza in America, and measles	21313	1825	434	97
1758	Hot —	—	Meteor	—	Influenza in Europe; plague began in Egypt and Smyrna; measles in America	17576	1558	524	129
[illegible]	Hot —	Severe —	Comet	Vesuvius [illegible]	Measles and dysentery in America; plague in Levant	19604	1752	629	271

A.D.	Seasons. Summer.	Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Dublin.	Boston.	Xst. Ch. & St. Peter's, Philadel.
1760	—	—	—	Vesuvius —	Plague in Levant; fevers in America	19830	1993	576	174
1761	Verydry, Am.	—	—	Azores —	Influenza in America, and malignant fever; plague in Levan	21063	2192	465	144
1762	Verydry, Am.	Very severe	Comet	— —	Influenza in Europe; pestilence in Philadelphia; crisis of plague in Aleppo	26326	2490	531	200
1763	—	—	Meteor	Etna —	Pestilence at Nantucket, and at Bengal; mortality among animals	26143	2605	407	180
1764	Hot, Europe	—	—	Etna —	Pestilence at Cadiz, and in Naples, small-pox in Boston	23202	2307	548	139
1765	Hot, Europe	Severe, Eu.	—	— —	Dysentery in Europe —	23230	2275	560	186
1766	Hot & dry	Very severe	Comet	Etna, Vesu. & Heckla	Dysentery in America —	23911	Par. n	445	133
1767	—	Cold	Comet	Vesuvius, great	Influenza in Europe —	22614	19875	468	121
1768	Hot	—	—	— —	Diseases among horses in America	23639	20808	417	123
1769	Hot	—	Comet	— —	Measles and sore-throat in America; diseases among cattle	21847	19417	645	198
1770	Wet, Eng.	—	Comet	Ternate and Vesuvius	Sore-throat in America and West-Indies; plague in Constantinople	22434	19719	483	127
1771	Wet, A. & E	Cold, Eu.	Meteor	Vesuvius —	Plague in Russia; diseases among cattle; pestilence in Bengal	21770	18941	482	139
1772	Hot, Am.	Cold spring	—	— —	Influenza and measles in America	26053	20374	517	157
1773	—	—	—	— —	Measles, anginas, and dysentery in America; plague at Bassora and Bagdad	21656	18518	595	179
1774	—	Severe Eu.	—	— —	Scarlet fever in Edinburgh and Philadelphia	20884	—	596	161
1775	—	—	Meteor	Gustimala —	Influenza in Europe; anginas and dysentery in America	20541	18400	—	156
1776	Hot&wet, A.	Severe Eu.	—	Vesuvius —	Dysentery and anginas in America	19048	—	—	180
1777	—	—	—	Ferro —	Dysentery and anginas in America	23334	—	—	222
1778	Hot	Very mild	—	— —	Plague in Constantinople; typhus in America	20399	17112	—	183

nomena of the elements as I have been able to collect.

As winter makes a part of two years, the word *ſevere* is ſet againſt the year in which the winter began. Thus againſt the year 1607, the word *ſevere* refers to the winter of 1607—8. The blanks denote either that nothing ſingular occurred in thoſe years, or that I have no account of the occurrences. Further enquiries might probably enable me to fill many of thoſe blanks.

Bills of Mortality do not exhibit a complete view of epidemics, as ſome of the moſt remarkable, eſpecially influenza, deſtroy but few lives; and the bills of the years when that diſeaſe alone prevailed are remarkably low. It is often the immediate precurſor, in ſpring, of peſtilential diſeaſes in autumn, in which caſes the bills of the year are very high.

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By common Diseases.	Burials in London. By the Plague.	Burials in London. Total.	Burials in Augsburg.
1600	—	—	—	—	Pestilence general — —	—	—	—	1775
1601	Very dry	Severe	—	South America	Plague in Portugal, and many places	—	—	—	1570
1602	Cool & dry	Cold	—	—	Influenza, plague — —	—	—	—	1567
1603	—	—	—	—	Plague in London, and general famine	5773	36269	42042	1488
1604	—	—	Comet	South America	— — —	4323	896	5219	1298
1605	—	—	—	—	— — —	5948	444	6392	1361
1606	—	—	—	—	— — —	5796	2124	7920	1371
1607	Hot	Severe	Comet	Etna —	Plague in Cork — —	5670	2352	8022	2595
1608	Hot	—	—	—	Plague in Cork; dysentery —	6758	2262	9020	1496
1609	—	Severe	Comet	Etna —	Plague in Denmark — —	7554	4240	11784	1469
1610	Very dry	—	—	—	Influenza in Europe; anginas in Spain	7486	1803	9289	1941
1611	—	—	—	—	Plague in Constantinople —	6716	627	7343	1891
1612	Very dry	—	Comet	—	Fevers — — —	7778	64	7852	1625
1613	—	—	—	—	Plague in Constantinople —	7503	16	7519	1722
1614	—	Severe	—	Etna —	Fatal small-pox in Europe; measles in Persia	7367	22	7389	1444
1615	Cool	—	—	—	— — —	7850	37	7887	1771
1616	Hot & dry, England	—	—	—	— — —	8063	9	8072	1631
1617	Hot & dry, England	—	—	—	— — —	8280	6	8286	1514
1618	—	—	Comets	—	Pestilence among the Indians in America; fatal anginas in Naples —	9596	18	9614	1354
1619	—	—	—	Iceland —	Pestilential fevers in France —	8000	9	8009	1485

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com. Diseases.	Burials in London. By the Plague.	Burials in London. Total.	Burials in Augs.	Burials in Dresn.
1620	—	Cold	Comet	— —	Fevers —	9691	21	9712	1667	—
1621	—	—	—	— —	Small-pox — —	8112	11	8123	1517	—
1622	Dry, Am.	—	Comet	— —	Malignant fevers, precursors of plague	9420	16	9436	1959	—
1623	—	—	—	— —	Malignant fevers, as above —	11095	17	11112	1875	421
1624	—	—	—	— —	Malignant fevers, &c. —	12199	11	12210	1370	421
1625	—	—	Comet	Iceland and Canaries	Plague in London, Denmark and Italy, Holland, &c. —	18848	35417	54265	1392	481
1626	Hot	—	—	— —	Plague in Lyons, Wirtemberg, &c.	7400	134	7534	1440	740
1627	—	—	—	— —	Plague in France, &c. —	7713	4	7717	2404	412
1628	—	—	—	— —	Plague in France, Augsburgh, &c.	7740	3	7743	5611	—
1629	—	—	—	— —	Plague in Amsterdam, &c. —	8771	—	8771	1265	398
1630	—	—	—	— —	Plague in Vienna; in Cambridge, England	9228	1317	9545	909	480
1631	—	—	—	Vesuvius —	Erysipelas, diseases in the throat —	8288	274	8562	859	644
1632	—	—	—	Vesuvius —	Eruptive fevers; pestilence in Dresden, Augsburgh, &c. — —	9527	8	9535	3485	3129
1633	Hot	Severe, Eu	Comet	Etna —	Plague in Dresden, &c.—Pestilence in America —	8392	—	8392	3364	4585
1634	Hot	Severe Am.	—	Etna —	Plague in Ratisbon; pestilential fevers in London; precursors of the plague	10899	1	10900	4664	721
1635	—	Mild	—	Vesuvius and Etna	Plague in Augsburgh, Leyden, Mentz, &c.; pestilential fevers in London —	10651	—	10651	6243	597
1636	—	—	—	Etna and Heckla	Plague in London, Nimeguen, Rome, &c.	12959	10400	23359	790	594
1637	Hot, Eng.	Severe	—	— —	Plague in Holland, Denmark, &c.	8681	3082	11763	823	1897
1638	Hot & dry	—	—	— —	Sickness in America; small-pox and fevers in Europe — —	13261	363	13624	638	531
1639	Dry, Am.	—	—	— —	— —	9548	314	9862	674	1845

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com. Diseases.	Burials in London. By the Plague.	Burials in London. Total.	Burials in Augsb.	Burials in Drsd.
1640	—	Sever Eu.	—	—	— — —	11321	1450	12771	586	935
1641	—	Severe Am	—	—	— — —	11767	1375	13142	587	525
1642	—	—	—	—	— — —	11999	1274	13273	593	601
1643	Hot & dry	—	—	Etna and Vesuvius	— — —	12216	996	13212	638	1041
1644	—	—	—	—	— — —	9441	1492	11933	659	459
1645	Hot, Eng.	—	—	—	Sickness among the Indians in America	9608	1871	11479	758	538
1646	—	—	—	—	Plague increafed in London —	10415	2365	12780	1488	481
1647	Hot, Am.	—	Comet	—	Increafe of plague in London, influenza and peftilential fever in America	10462	3597	14059	1398	471
1648	—	—	—	—	Plague in Ireland, malignant fevers in Italy, France, and Spain	9283	611	9894	1208	606
1649	—	—	—	—	Plague in Spain, small-pox in Boston	10499	67	10566	940	597
1650	—	—	—	Etna —	Plague in Cork; influenza in Europe	8749	15	8764	533	494
1651	Hot	—	—	—	Quinsey in Italy — —	10444	23	10467	577	511
1652	Dry, Eng.	—	Comet	—	Fevers — — —	12598	16	12604	616	450
1653	Dry, Eng.	—	—	—	Sicknefs in New England —	10081	6	10087	575	535
1654	—	Severe	—	—	Plague in Denmark, Turkey, Chester in England, &c.	13231	16	13247	764	558
1655	Dry, Eng	—	—	Vesuvius	Plague general in Europe; influenza in America — —	11368	9	11377	570	525
1656	Hot	—	—	—	Plague in Italy, &c. —	13915	6	13921	641	560
1657	Hot	Severe	—	—	Plague in Genoa — —	12430	4	12434	731	663
1658	Wet, Am.	—	—	—	Influenza in Europe; sicknefs in America	14079	14	14093	231	518
1659	—	—	—	—	Cynanche trachealis in America	14720	36	14756	831	599

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com Diseases.	Burials in London. By the Plague	Burials in London. Total.	Burials in Augs.	Burials in Dresd.
1660	—	—	—	Iceland & Vesuvius	Measles in England	15104	14	15118	657	542
1661	—	—	Comet	—	Measles; tertians severe in London for four years	19791	20	19811	668	649
1662	Dry, Am.	—	—	—	Sickness in America	16542	12	16554	788	637
1663	—	Mild	—	—	Fevers; diseases among cattle; plague in Holland	15347	9	15356	836	620
1664	Wet	Severe	Comet	Etna	Purple fevers in Prussia; corn first mildewed in America	18291	6	18297	761	662
1665	—	—	Comet	Etna	Plague in London and over Europe	28710	68596	97306	745	699
1666	Hot and dry	—	Comet	Etna	Dysentery over Europe; small-pox in Boston	10840	1998	12838	737	824
1667	—	—	—	Etna	Fevers	15841	36	15877	769	823
1668	Hot	Severe	Comet	Etna	Pestilence in New York; small-pox in Europe	Plague in London ceased.		17194	711	703
1669	Hot	Severe	—	Etna, great	Dysentery, fevers, measles, in Europe; cat plague in Westphalia			19436	743	794
1670	—	—	—	Etna	Measles in London; small-pox			20198	734	776
1671	—	—	—	Etna	—			15729	733	743
1672	—	Cold	Comet	Etna	Measles and small-pox			18230	768	909
1673	Cold, Eng.	—	—	Etna	Catarrhs			17504	751	909
1674	—	—	—	Etna	Measles and small-pox			21201	842	846
1675	Wet & cool, Eng.	Severe	Meteor	Etna	Influenza in Europe			17244	913	947
1676	—	—	Meteor	Etna	Measles and small-pox			18732	913	1284
1677	—	—	Comet	Etna	Small-pox in Charlestown, in Massachusetts; dysentery in Denmark			19067	934	887
1678	Dry and hot	—	Comet	Etna	Severe plague on the Barbary Coast; small-pox in Boston and in South America			20678	943	1020

A.D.	Seasons.		Comets.	Eruptions of Volcanos.	Diseases Epidemic.	Burials in		
	Summer.	Winter.				London.	Augsb.	Dresden.
1679	—	Severe	Comet	Etna	Catarrh in Europe; plague in Vienna	21730	945	975
1680	Hot and dry	Severe	Comet	—	Plague in Dresden; coughs, dysentery	21053	976	6414
1681	Very dry	—	—	—	— — —	23971	860	753
1682	—	—	Comet	Etna and Vesuvius	— — —	20691	734	1023
1683	—	Very severe	Comet	—	Plague at Halle; spotted fever in Dublin; murrain among cattle	20587	808	1200
1684	Hot and dry, Eng.	Cold in Eng.	—	—	Malignant dysentery over Europe	23202	858	1154
1685	Hot and dry, Eng.	—	—	—	— — —	23222	848	937
1686	Dry, Italy	—	Comet	Etna and a meteor	— — —	22609	981	1199
1687	Rainy, Europe	—	—	—	— — —	21460	855	927
1688	—	Severe	—	Vesuvius	Influenza in Europe	22921	860	1011
1689	Rainy, Autumn	—	Comet	Etna and Vesuvius	Small-pox in Boston; spotted fever in Germany — —	23502	806	1163
1690	Rainy	Severe	—	—	Corn mildewed —	21461	1071	1200
1691	Hot and dry	—	—	—	Corn blasted; diseases among cattle; spotted fever in Europe —	22691	785	[illegible]
1692	Hot	—	—	Etna	Malignant fevers in Europe —	20874	935	999
1693	—	Cold, Europe	—	Etna and Iceland	Influenza in Europe —	20959	1084	1071
1694	Hot	—	—	Vesuvius and Banda	Malignant fevers — —	24100	1106	1426
1695	Rainy, Europe	—	—	—	Apoplexies in Italy; measles and chin-cough in Europe; sickness in America	19047	1048	1227
1696	Cold & wet, Eng.	—	—	—	Dysentery among children; spotted fevers	18638	927	1055
1697	—	Severe	—	—	Spotted fevers in Europe; Influenza in America began — —	20970	777	1070
1698	—	Severe	Comet	South America	Influenza in America; spotted-fever in Europe; malignant pluerisy in America	20183	877	919
1699	Hot, America	—	Comet	—	Influenza in Europe; plague in Philadelphia and Charlestown, and Levant	20795	940	1139
1700	—	Mild	—	—	Sore throat in Levant; catarrhs and measles in Europe —	19443	786	1198

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London. By com Diseases.	Burials in London. By the Plague	Burials in London. Total.	Burials in Augs.	Burials in Dresd.
1660	—	—	—	Iceland & Vesuvius	Measles in England — —	15104	14	15118	657	542
1661	—	—	Comet	—	Measles; tertians severe in London for four years — — —	19791	20	19811	668	649
1662	Dry, Am.	—	—	—	Sicknefs in America —	16542	12	16554	788	637
1663	—	Mild	—	—	Fevers; diseases among cattle; plague in Holland — —	15347	9	15356	836	620
1664	Wet	Severe	Comet	Etna	Purple fevers in Prussia; corn first mildewed in America — —	18291	6	18297	761	662
1665	—	—	Comet	Etna	Plague in London and over Europe	28710	68596	97306	745	699
1666	Hot and dry	—	Comet	Etna	Dysentery over Europe; small-pox in Boston	10840	1998	12838	737	824
1667	—	—	—	Etna	Fevers — — —	15841	36	15877	769	823
						Plague in London ceased.				
1668	Hot	Severe	Comet	Etna	Pestilence in New York; small-pox in Europe			17294	711	703
1669	Hot	Severe	—	Etna, great	Dysentery, fevers, measles, in Europe; cat plague in Westphalia —			19436	743	794
1670	—	—	—	Etna	Measles in London; small-pox			20198	734	776
1671	—	—	—	Etna	— — —			15729	733	743
1672	—	Cold	Comet	Etna	Measles and small-pox —			18230	768	909
1673	Cold, Eng.	—	—	Etna	Catarrhs — — —			17504	751	909
1674	—	—	—	Etna	Measles and small-pox —			21201	842	846
1675	Wet & cool, Eng.	Severe	Meteor	Etna	Influenza in Europe — —			17244	913	947
1676	—	—	Meteor	Etna	Measles and small-pox —			18732	913	1284
1677	—	—	Comet	Etna	Small-pox in Charlestown, in Massachusetts; dysentery in Denmark —			19067	934	887
1678	Dry and hot	—	Comet	Etna	Severe plague on the Barbary Coast; small-pox in Boston and in South America			20678	943	1020

A.D.	Seasons.		Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in		
	Summer.	Winter.				London.	Augsb.	Dresden.
1679	—	Severe	Comet	Etna	Catarrh in Europe; plague in Vienna	21730	945	975
1680	Hot and dry	Severe	Comet	—	Plague in Dresden; coughs, dysentery	21053	976	6414
1681	Very dry	—	—	—	— — —	23971	860	753
1682	—	—	Comet	Etna and Vesuvius	— — —	20691	734	1023
1683	—	Very severe	Comet	—	Plague at Halle; spotted fever in Dublin; murrain among cattle	20587	808	1200
1684	Hot and dry, Eng.	Cold in Eng.	—	—	Malignant dysentery over Europe	23202	858	1154
1685	Hot and dry, Eng.	—	—	—	— — —	23222	848	937
1686	Dry, Italy	—	Comet	Etna and a meteor	— — —	22609	981	1199
1687	Rainy, Europe	—	—	—	— — —	21460	855	927
1688	—	Severe	—	Vesuvius	Influenza in Europe	22921	860	1011
1689	Rainy, Autumn	—	Comet	Etna and Vesuvius	Small-pox in Boston; spotted fever in Germany — —	23502	806	1163
1690	Rainy	Severe	—	—	Corn mildewed —	21461	1071	1200
1691	Hot and dry	—	—	—	Corn blasted; diseases among cattle; spotted fever in Europe —	22691	785	11[illegible]
1692	Hot	—	—	Etna	Malignant fevers in Europe —	20874	935	999
1693	—	Cold, Europe	—	Etna and Iceland	Influenza in Europe —	20959	1084	1071
1694	Hot	—	—	Vesuvius and Banda	Malignant fevers — —	24100	1106	1426
1695	Rainy, Europe	—	—	—	Apoplexies in Italy; measles and chin-cough in Europe; sickness in America	19047	1048	1227
1696	Cold & wet, Eng.	—	—	—	Dysentery among children; spotted fevers	18638	927	1055
1697	—	Severe	—	—	Spotted fevers in Europe; Influenza in America began — —	20970	777	1070
1698	—	Severe	Comet	South America	Influenza in America; spotted-fever in Europe; malignant pluerisy in America	20183	877	919
1699	Hot, America	—	Comet	—	Influenza in Europe; plague in Philadelphia and Charlestown, and Levant	20795	940	1139
1700	—	Mild	—	—	Sore throat in Levant; catarrhs and measles in Europe —	19443	786	1198

A.D.	Seasons. Summer.	Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Augsb.	Dresden.	Boston.
1701	Hot and dry	—	—	Vesuvius	Plague in the East —	24071	906	992	146
1702	Hot and dry	—	Comet	Etna	Plague in Poland and in New York; small pox in Boston —	19481	900	946	441
1703	—	—	—	—	Plague in Poland — —	20720	1245	1078	159
1704	Dry, Europe	—	—	Ves.&Teneffe.	Plague in Poland and Hungary	22684	1313	964	220
1705	—	—	—	—	Plague in Russia —	22097	748	1346	282
1706	Hot & dry, Eng.	—	Comet	—	Coughs and dysentery among children	19847	842	1098	261
1707	Very hot	—	Comet	Vesuvius	Measles in England —	21600	805	1523	[illegible]
1708	—	Very severe	—	Meteor	Catarrh began in Europe; plague in Thorn	21291	908	1119	298
1709	—	—	—	—	Catarrh, epidemic, plague in Dantzick; apoplexies —	21800	805	1340	377
1710	—	—	—	—	Plague in Lithuania; catarrhous fevers in England and Holland —	24620	811	1214	295
1711	—	Cold, Europe	—	—	Plague in Copenhagen, and among cattle terrible —	19833	855	1222	363
1712	Wet, England	—	Comet	Vesuvius	Catarrh in Europe; plague in the East	21198	894	1140	316
1713	Wet, England	Mild	—	—	Measles in America; plague in Austria	21057	860	1383	450
1714	Dry and hot, Eng.	—	—	—	— — —	26569	948	1250	413
1715	Dry, England	—	—	—	Small-pox and measles in England	22232	1024	1353	336
1716	Very dry, Eng.	Severe	—	—	— — —	24436	905	1274	355
1717	—	Great snow in Am.	Comet	Vesuvius	Catarrhs in Europe —	23446	988	1908	451
1718	Hot & wet, Eng.	—	Comet	—	Malignant fevers; plague in Turkey	26523	768	1412	380
1719	—	—	Comet Meteor	—	Plague in Levant; pestilential fevers, malignant pleurisy in America	28347	997	—	304

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London	Burials in Dublin.	Burials in Dresden.	Burials in Boston.	Burials in Xst-Ch. & St. Peter's, Philadel.
1720	Dry, Europe	—	—	—	Plague in Levant, and in Marseilles; malignant fever in America	25454	—	1733	329	—
1721	—	—	—	Iceland	Small-pox in Boston	26142	—	1850	1102	—
1722	Cold & wet, Eng.	—	—	—	Measles in England	25750	—	1519	273	—
1723	—	Cold	Comet	—	Small-pox in England, and plague in Barbadoes	29197	—	1654	413	—
1724	Wet, England	—	—	—	Hooping-cough in England	25952	—	1761	407	—
1725	Wet, England	—	—	Two in Iceland	—	25523	—	1642	324	—
1726	—	—	—	—	Plague in Egypt	29647	2763	—	343	69
1727	Very hot, Am.	—	Comet	Vesu. & Iceland	Sickness in America	28418	2946	—	479	130
1728	Hot, Am.	—	—	Iceland	Plague in Egypt, and in Carolina	27810	—	—	498	86
1729	—	—	Comet	Iceland	Epidemic catarrh in Europe; plague in Aleppo; measles and malignant pleurisy in America	29722	3206	—	570	88
1730	—	Severe Eu.	—	Vesu. & Iceland	Small-pox in Boston; pestilential fevers in South America	26761	2184	—	909	81
1731	—	—	—	—	Small-pox in New York; anginas in Holland	25262	—	—	408	166
1732	—	Severe Am.	Comet	—	Plague in Syria, and Charlestown, S. Carolina	23358	2534	—	499	97
1733	Dry, England	—	—	—	Universal catarrh; plague in Aleppo	29233	2608	—	458	103
1734	—	—	—	—	Scarlatina in Edinburgh; small-pox and fevers in Europe	26062	2466	—	528	116
1735	Wet	—	—	—	Sore-throat in America; measles, coughs, catarrhs, fevers, hydrophobia, in Europe	23538	2196	—	455	96
1736	Wet, Am.	—	—	—	Sore-throat in America and France, measles in England; dreadful plague in Egypt	27581	2101	—	617	144
1737	—	Veryfev.Am.	Comet	Vesuvius	Severe catarrh universal; diseases among horses	27823	—	—	607	112
1738	—	—	—	—	Measles in America; pestilence in Barbadoes, New Spain, Oczakow	25825	2506	—	576	107
1739	Wet, England	Very fev. Eu.	Comet	—	Pestilence in Charlestown, measles in Amer.	25432	2201	—	554	97

A.D.	Seasons. Summer.	Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Dublin.	Boston.	Xst. Ch. & St. Peter's, Philadel.
1740	—	In Am. very seve e	—	—	Measles in America; hooping cough and spotted feves in England	30811	—	704	98
1741	—	—	—	—	Pestilence in Philadelphia and Virginia; spotted fever in England	32169	2790	555	162
1742	—	Severe, Syria	Comet	—	Sore-throat in America and England; plague in Syria, &c.	27483	2320	517	123
1743	Hot —	—	Comet	South America	Plague in Syria, Messina, New York, &c. catarrh in Europe	25200	2193	600	116
1744	—	—	—	—	Influenza in Europe —	20606	1705	497	114
1745	—	—	—	—	Plague in Egypt; fevers and dysentery in America	21296	—	780	125
1746	—	—	—	South America	Fever at Albany: dysentery in Switzerland	28157	1957	578	186
1747	Hot and dry	Severe —	—	Etna	Pestilence at Philadelphia; anginas in England; catarrh in Europe	25494	—	777	192
1748	Dry —	—	—	—	Pestilence in Charlestown; long fever in America; anginas in England	23869	1530	740	175
1749	Very dry, America	—	—	—	Dysentery in Europe and America; long fever; anginas in England	25516	1819	677	128
1750	Very hot, America	Very fevere	Comet	—	Dysentery and anginas in America and Europe, plague on the Barbary Coast	23727	2088	604	125
1751	Wet, England	Severe —	—	Vesuvius	Dysentery and anginas in America; plague in Turkey	21028	—	624	144
1752	Very hot, America	—	—	—	Small-pox in Boston; dysentery and anginas in America and Ireland	20485	1844	1009	129
1753	—	Severe —	—	—	Dysentery and anginas in America	19276	1825	481	105
1754	—	Mild in America	—	Vesuvius	Gangrenous sore-throat in England, Ireland, and America	22696	1897	434	94
1755	—	Severe, Europe	—	Etna	Influenza in Europe; anginas in Europe and America; plague in Turkey	21917	2002	484	99
1756	—	Severe, Syria	Comet	Iceland	Influenza in America began	20872	1550	526	125
1757	—	—	—	—	Influenza in America, and measles	21313	1825	434	97
1758	Hot —	—	Meteor	—	Influenza in Europe; plague began in Egypt and Smyrna; measles in America	17576	1558	524	129
1759	Hot —	Severe —	Comets	Vesuvius, great	Measles and dysentery in America; plague in	10604	1752	620	[illegible]

A.D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Burials in Dublin.	Burials in Boston.	Burials in Xt. Ch. & St. Peter's Philadel.
1760	—	—	—	Vesuvius —	Plague in Levant; fevers in America	19830	1993	576	174
1761	Verydry, Am.	—	—	Azores —	Influenza in America, and malignant fever; plague in Levant	21063	2292	465	144
1762	Verydry, Am.	Very severe	Comet	— —	Influenza in Europe; pestilence in Philadelphia; crisis of plague in Aleppo	26326	2490	531	200
1763	—	—	Meteor	Etna —	Pestilence at Nantucket, and at Bengal; mortality among animals	26143	2605	407	180
1764	Hot, Europe	—	—	Etna —	Pestilence at Cadiz, and in Naples; small-pox in Boston	23202	2307	548	139
1765	Hot, Europe	Severe, Eu.	—	— —	Dysentery in Europe —	23230	2275	560	186
1766	Hot & dry	Very severe	Comet	Etna, Vesu. & Heckla	Dysentery in America —	23911	Paris.	445	133
1767	—	Cold	Comet	Vesuvius, great	Influenza in Europe —	22612	19575	463	121
1768	Hot	—	—	— —	Diseases among horses in America	23639	20408	417	123
1769	Hot	—	Comet	— —	Measles and sore-throat in America; diseases among cattle	21847	[illegible]	645	198
1770	Wet, Eng.	—	Comet	Ternate and Vesuvius	Sore-throat in America and West-Indies; plague in Constantinople	22434	19719	483	127
1771	Wet, A. & E.	Cold, Eu.	Meteor	Vesuvius —	Plague in Russia; diseases among cattle; pestilence in Bengal	21770	18941	482	139
1772	Hot, Am.	Cold spring	—	— —	Influenza and measles in America	26053	20374	517	157
1773	—	—	—	— —	Measles, anginas, and dysentery in America; plague at Bassora and Bagdad	21656	17318	595	179
1774	—	Severe Eu.	—	— —	Scarlet fever in Edinburgh and Philadelphia	20884	—	596	161
1775	—	—	Meteor	Guatimala —	Influenza in Europe; anginas and dysentery in America	20541	18400	—	156
1776	Hot&wet, A.	Severe Eu.	—	Vesuvius —	Dysentery and anginas in America	19048	—	—	180
1777	—	—	—	Ferro —	Dysentery and anginas in America	23334	—	—	222
1778	Hot	Very mild	—	— —	Plague in Constantinople; typhus in America	20399	17112	—	183

A. D.	Seasons. Summer.	Seasons. Winter.	Comets.	Eruptions of Volcanoes.	Diseases Epidemic.	Burials in London.	Burials in Salem Mass.	Burials in Xst. Ch. & St Peter's, Philadel.
1779	Hot	Very severe	—	Vesu. great	Health —	20420	—	142
1780	Hot, America	—	Halo	Etna	Some fever in Philadelphia; general health in America; plague in Smyrna	20517	—	158
1781	—	—	—	—	Influenza in America	20709	—	179
1782	Dry autumn	—	—	—	Influenza in Europe; scarlatina began in Edin.	17918	175	198
1783	Hot	Very severe	Many mets.	Heckla, great	Measles and scarlatina in America; famine in India; plague in Egypt	19029	189	232
1784	Hot	—	Comet	Vesuvius	Angina in America, and canine madness; plague and famine in the East	17828	140	230
1785	Dry, Europe	Cold	—	Vesuvius	Angina and fevers in America	18919	114	166
1786	Cool —	Cold	—	—	Yellow fever in Cadiz; angina in America and England	20454	138	156
1787	Cool —	—	—	Etna & Vesu.	Plague on the Barbary Coast; general health	19347	110	147
1788	Rainy, America	Cold, Am sev. Eu	Met. Com.	—	Measles began in America; sickness of cod-fish; influenza in Europe	19697	144	126
1789	Cool spr. hot sum.	Mild, America	Halo	Vesuvius	Measles and influenza in America, famine in India and China; dearth in America; plague in the East; death of haddock	22744	129	164
1790	—	—	—	—	Influenza a second time epidemic in America	18038	203	145
1791	Very hot, America	Cold, America	—	—	Pestilence began in Egypt, Grenada, and New York	18760	148	183
1792	—	Cold, America	—	—	Pestilence in Egypt; scarlatina began in Am.	20213	148	125
1793	Dry & very hot, Am.	Mild, America	Comet	—	Scarlatina in America and London; pestilence in Philadelphia, dysentery in Maryland	21749	148	393
1794	—	Mild, Am. sev. Eu.	—	Vesuvius, great	Scarlatina; pestilential fever in Newhaven and Baltimore; dysentery in Derby	19241	122	172
1795	Hot & rainy, Am.	—	—	—	Scarlatina in Boston; pestilence in New York and Norfolk, dysentery in Newhaven; influenza in Europe	21179	195	223
1796	Dry autumn, Am.	Cold, America	—	—	Scarlatina in Boston and Newhamp. pestilence in New York, Boston, Charlestown, and Newberry-port; measles in America	19288	216	213
1797	Cool, America	Severe, America	Comet	—	Influenza in Europe; pestilence in Philadelphia, Baltimore, Norfolk, and Providence; canine madness; plague among cats, and in Turkey	17014	147	197
					Pestilence in Philadelphia, New York, Bos-			

SECTION X.

Remarks, on the preceding History and Tables.

IMPERFECT as ancient hiſtory is, in regard to the account of diſeaſes, and the extraordinary phenomena of nature, we find that between the year B. C. 480 and the Chriſtian era, a number of violent plagues occurred, moſt of which coincided in time with the following phenomena: comets, eruptions of volcanoes, earthquakes, drought, ſevere winters, diſeaſes among cattle. Of thirteen comets mentioned in the foregoing hiſtory, which are all whoſe dates I am able to aſcertain, *eight* of them coincide with volcanic eruptions of Etna, the only volcano of any note which the hiſtory of that period has recorded; and eleven of them coincide in time with peſtilence. If we conſider the ſcarcity of our materials for a hiſtory of theſe phenomena at that period, and make due allowances for the uncertainty of chronology, we ſhall find reaſon to be ſurprized at ſuch a number of theſe coincidences. In ſeveral inſtances we find extreme drought and very ſevere winters to correſpond in time with comets and eruptions of Etna, conformable to facts in modern days.

On this ſubject hiſtory is barren alſo for many centuries after the Chriſtian era. Yet in every period, even of the dark ages, we find numerous coincidences of the great phenomena abovementioned. All the great plagues that have afflicted mankind, have been accompanied with violent agitations of the elements*.

This obſervation reſts particularly on the events that preceded and attended the peſtilences of the following periods, A. D.—80, 167, 252, 375, 400, 445, 542, 558, 590, 639, 679, 682, 746, 762, 802, 905, 994, 1005, 1031, 1044, 1069, 1106, 1135, 1142, 1162, 1181, 1222, 1242, 1300, 1347, 1368, 1400, 1477, 1500, 1531, 1577, 1602, 1625, 1636, 1665, 1699, 1709, 1719, 1728, 1743, 1751, 1760, 1770, 1783, 1789. Many facts in other periods, concur to prove the truth of the remark.

* Modern philoſophy objects to the popular ſenſe in which the word *elements* is uſed; ſince it appears that what has uſually been conſidered as an *element*, is found, by modern chemiſtry, to be a compound ſubſtance, reſolvable into parts, in their nature and properties diſtinct. Notwithſtanding theſe diſcoveries, I cannot conſent to diſcard the popular uſe of the word *element*. Nature preſents to the ſenſes of man fire, earth, air, and water, in particular and predominant form. This is the form in which they appear to be moſt uſeful to man, and to be the conſtituent materials of other ſubſtances, as well as the agents in carrying on the great viſible operations of the ſyſtem. I therefore conſider the popular diſtribution as natural and convenient.

The

The phenomenon moſt generally and cloſely connected with peſtilence is an earthquake. From all the facts that I can find in hiſtory, I queſtion whether an inſtance of a conſiderable plague in any country can be mentioned which has not been immediately preceded or accompanied with convulſions of the earth. If any exceptions have occurred, they have eſcaped my reſearches. It does not happen that *every place* where peſtilence prevails is ſhaken; but during the progreſs of the diſeaſes which I denominate *peſtilence*, and which run, in certain periods, over large portions of the globe, ſome parts of the earth, and eſpecially thoſe which abound moſt with ſubterranean fire, are violently agitated.

By adverting to the foregoing hiſtory, the reader will find that all thoſe years in which conſiderable earthquakes have occurred in America have been remarkably ſickly. Theſe years are 1638, 1647, 1658, 1662 and 3, 1668, 1727, 1755, 1783. See the hiſtory and the Bills of Mortality. Even the ſlighter ſhocks have been attended with conſiderable ſickneſs, or have introduced a ſeries of epidemics, being contemporary with the meaſles, influenza, or ſore throat, as in 1669, 1720, 1737, 1757, 1761, 1769, 1771, 1791, 1797.

To enumerate the inſtances in Europe and Aſia would be a uſeleſs repetition of the events related

related in the preceding hiſtory, to which the reader is referred.

Another phenomenon, which, next to earthquakes, appears to be moſt cloſely connected with epidemic diſeaſes, is the eruption of fire from volcanic mountains. In this article hiſtory is deficient, or I have not been able to find the works neceſſary to furniſh a complete view of theſe phenomena. There are whole centuries in which the books I have conſulted mention no eruption of Etna and Veſuvius. The account of eruptions in Iceland, from the year 1000, taken from Pennant's Arctic Zoology, vol. i. 331, is probably complete, or nearly ſo. Of the volcanoes in the Andes we have very few accounts, as well as of thoſe in the Moluccas. Of thoſe in the Arctic regions of Aſia and America we know very little.

Notwithſtanding theſe defects, we are able, by the eruptions in Italy, Sicily, and Iceland, to arrive to ſome very important concluſions. The reader muſt have noticed in the preceding hiſtory the coincidences in time between volcanic diſcharges and winters of unuſual ſeverity. Theſe diſcharges either precede or follow the winter. Thus the eruptions of 1766, 1779, and 1783, were immediately followed by intenſely cold winters. The ſevere winters of 1762—3 and 1779—80, were ſpeedily followed by eruptions. Theſe inſtances will ſerve as ſamples of the ordinary

nary courſe of theſe events. Sometimes the eruptions continue, or are repeated, for a number of years in ſucceſſion; but the eruptions, when continued, are moderate, and the ſeaſons variable. When the volcanoes have been for ſome years quiet, and that ſuſpenſion is followed by a great diſcharge, it appears to me that ſevere winters invariably follow or precede the diſcharge within a few months. So alſo, when an eruption is continued for a number of years, if at any time the diſcharge becomes violent, a ſevere winter attends it, as in 1669. Etna was in a ſtate of eruption from 1664 to to 1679; but in 1669 the diſcharge was immediately augmented, and the winters next preceding and following were very ſevere.

There are ſome years in which eruptions are noted, of which I find no account reſpecting the ſeaſons. Perhaps ſome of theſe will, on further inveſtigation, be found to be exceptions.

It is to be obſerved, that in ſome caſes a ſevere winter extends to both hemiſpheres, ſometimes to one only, and in a few caſes to a part of a hemiſphere only. Thus in 1607—8, 1683—4, 1762—3, 1766—7, 1779—80, 1783—4, the ſeverity extended to both hemiſpheres. In 1640—41, 1739—40, and in other inſtances, the ſevere winter in Europe preceded, by one year, a ſimilar winter in America. In a few inſtances, ſevere froſt takes place in one hemi-

ſphere during a ſeries of mild winters in the other; but this is leſs common. In general, the ſeverity happens in both hemiſpheres at once, or in two winters in immediate ſucceſſion; and, as far as evidence has yet appeared, this ſeverity is cloſely attendant on volcanic diſcharges, with very few exceptions.

Another phenomenon, which uſually coincides in time with ſevere winters, is the approach of comets. I have been ſtruck with ſurprize at the coincidences of this kind. There are a few inſtances on record of mild winters during the appearance of theſe bodies; but in theſe caſes the comets have appeared to be ſmall, or to paſs the ſyſtem at an immenſe diſtance from the earth. The large comets, and thoſe which approach near the earth, *ſeem* to produce almoſt uniformly great heat, exceſſive drought, followed by very cold winters, tremendous ſtorms of wind, rain, ſnow, and hail, unuſual tides, or ſwell of the ocean, and uſually volcanic eruptions. How far theſe phenomena are connected, as cauſe and effect, future obſervations may determine. Some of them occur ſo uniformly in the ſame year, that I cannot reſiſt the evidence of their connection.

After a volcano has been many years quiet, its diſcharges are, I believe, always preceded by extreme drought; and this defect of water is not only obſervable in the vicinity of the volcano,

but

but often extends over a whole continent, if not over the world. Many inſtances have been related: it is ſufficient here to mention the exceſſive drought in 1762 and 1782, preceding eruptions of Etna and Heckla. In theſe years almoſt all ſprings were exhauſted over a great portion of America.

Cold winters ſometimes follow wet ſeaſons, but more generally a very hot ſummer, or very dry autumn. Sometimes two or three ſevere winters occur in ſucceſſion, as in 1766—67 and 68, and in America from 1796 to 1799.

The years when comets approach, or volcanoes diſcharge fire, and when the atmoſphere exhibits fiery appearances, as meteors, ſtreams of light, and mock ſuns, are beyond compariſon the moſt tempeſtuous. Witneſs the years 1766, 1771 and 72, 1780, 1783, 4, and 5, 1788, 1797. In ſuch years the riſk on veſſels at ſea is greatly increaſed.

As dry ſeaſons uſually precede volcanic eruptions, ſo very wet ſeaſons often follow them. This ſeems not to be the invariable courſe of events; but there are remarkable inſtances of deluging rains after theſe diſcharges. Witneſs the ſeaſons following the univerſal convulſions of the earth in 1692 and 3, and 1766. Thus the electricity is reconducted to the earth.

In every caſe, I believe this remark will be found true, that the approach of comets and

volcanic eruptions disturb the regular course of the seasons. The heat of summer and the cold of winter are in extremes; more snow is generated in winter, and more hail in summer; tempests are more violent and frequent; meteors more numerous; and rain more unequally distributed over the earth.

A series of epidemic diseases, measles, influenza, affections of the throat, followed by pestilential fevers, appear generally to commence, and take their departure, from some of the great agitations of the elements above recited. This, at least, has been the case in America in the four last periods, beginning with 1756—7, 1769 and 70, 1782 and 3, 1788 and 9. This fact will want no authority but a bare inspection of the preceding history and tables.

The continuance and the varieties of the diseases seem to depend on similar disturbances in the elements; and as the discharges and motions of the electrical fluid depend on no certain laws that are known, they are irregular, and may contribute to vary the order and the nature of diseases. In some cases there has been a continued series of epidemics for twenty years, in which the common order is not exactly observed; but this is not frequent. A remarkable instance occurred between 1727 and 1744.

Those

Thofe periods, in general, have been moft diftinguifhed for ficknefs over the world, in which the fire of the earth has exhibited the moft numerous and violent effects. Witnefs the period from 1631 to 1637, when the three moft noted volcanoes difcharged immenfe quantities of fire and lava, and fevere peftilence extended over all Europe and America. A fimilar remark may be made concerning the period of the laft univerfal peftilence in Europe, from 1663 to 1666—alfo from 1691 to 1695—from 1727 to 30—from 1759 to 1764—1769 to 1772—1774 to 1777—1783 to 1786—and concerning fome fhorter periods, all of which produced epidemics in both hemifpheres.

Slighter eruptions and earthquakes, which are almoft annual, feem to have lefs effect. The fire of the globe is in perpetual motion or action; and to this great agent, philofophers are agreed, are to be afcribed the changes of feafons, and the generation of rain, hail, and fnow. Its operations, however, are not all of them vifible, nor even perceptible, until they appear by their effects. It is probable that the *invifible* operations of the electrical fluid produce more effects than thofe which are feen. Indeed, we may queftion whether moft of the vifible phenomena of that principle are not mere effects of that action which influences the vege-

table and animal world. It is probable to me, that neither ſeaſons, earthquakes, nor volcanic eruptions, are the cauſes of the principal l rangements we behold in animal and vegetable life, but are themſelves the *effects* of thoſe motions and inviſible operations which affect mankind. Hence catarrh and other epidemics often appear *before* the viſible phenomena of eruptions and earthquakes.

P. S.—After this work was prepared for the preſs, I was favoured, by Doctor Mitchel, with ſome extracts from a paper of Mr. Holm, a Swede, on the ſubject of a volcanic eruption in Iceland, in 1783, by which it appears that the atmoſphere is rendered peſtilential by diſcharges of fire and lava from the earth. This effect is ſuppoſed to be wrought by a combination of the ſeptous and oxygenous parts, and may confirm and improve Doctor Mitchel's theory of peſtilential air.

This eruption I underſtand to have been a burſting of fire from the earth, in a place diſtant from Heckla. In the neighbourhood of the column of flame were generated ſnow, hail, and extreme cold. The water that fell in rain was acid and corroſive—deſtroying cattle and men—covering the bodies of cattle with puſtules and

ulcers.

ulcers, and excoriating the hands and faces of men when it fell on them. It alſo killed vegetables. The effects were felt not only in Iceland, but in Norway and other parts of Europe.

Had this treatiſe fallen into my hands ſome months ago, I might have been able to illuſtrate particular parts of my theory by authentic facts taken from that work. As it is, I muſt content myſelf with obſerving, that Mr. Holm's obſervations verify my ideas reſpecting the agency of electricity in producing peſtilence and extremes in the ſeaſons. On this theory not only peſtilence, but ſevere cold, and extreme heat, hail, and ſnow, are all familiarly explained, and their connection with volcanic eruptions and other electrical operations, viſible and inviſible, demonſtrated.

SECTION XI.

Pestilential Periods, exhibited by Means of an Increase of Mortality in distant Parts of the World.

AS there are certain periods when particular epidemics prevail over the world, or over a hemisphere, and when all other diseases assume peculiar malignancy, I have here subjoined a number of bills of mortality for different and distant places, to shew the effect of the general principle of disease in remote countries or towns. Some of these periods appear in the foregoing tables, as that between 1623 and 1627, and between 1631 and 1637.

A similar period occurred between 1718 and 1721.

	Burials in			
A.D.	*London.*	*Amster—.*	*Vienna.*	*Breslaw.*
1716	24436	7078		
1717	23446	7451	5205	1458
1718	26523	8644	6110	1255
1719	28347	9726		
1720	25454	7820	6825	1816
1721	26142	7632	6490	1482

The plague raged in Turkey and Syria in 1718, 19, and 20, also at Marseilles in 1720; in which years, or one of them, the bills of mortality were swelled even in the north of Europe. I regret that some of the bills are deficient.

The

The period from 1725 to 1732 is equally remarkable.

A.D.	Burials in London.	Burials in Amsterdam	Burials in Dublin.	
1725	25523			Health.
1726	29647	9275	2763	Plague in Egypt and the Levant during this period.
1727	28418	13775	2946	
1728	27810	11164		
1729	29722	9618	3206	
1730	26761		2184	

From 1739 to 1743.

A.D.	Burials in London.	Burials in Amsterdam.	Burials in Dublin.	Burials in Boston.	Burials in Church in Philadelphia.	
1739	25432	7566	2201	554	97	Plague in Levant, Italy, and America.
1740	30810	10066		704	98	
1741	32169	9864	2790	555	162	
1742	27483		2320	517	123	
1743	25200		2193	620	116	

From the year 1744 to 1757 there were many ſickly years; but no one diſtinct period when an increaſe of mortality is obſervable in all parts of the world at the ſame time.

From

From 1758 to 1764.

Burials in

A.D.	*London.*	*Amfterdam.*	*Dublin.*	*Bofton.*	*Church in Philadelphia.*
1758	17526		1558	524	129
1759	19604		1752	629	271
1760	19830	7700	1993	576	174
1761	21063	7720	2292	456	144
1762	26326	8412	2490	531	200
1763	26143	9876*	2605	407	180
1764	23202	8585	2307	548	138
1765	23230	7725	2275	560	186

Plague in Egypt and the Levant from 1758 to 1763. Yellow fever in Philadelphia in 1762.

From 1770 to 1773.

Burials in

A.D.	*London.*	*Paris.*	*Amfterdam.*	*Bofton.*	*Church in Philadelphia.*
1770	22434	18719		483	127
1771	21770	18941	7983	482	139
1772	26053	20374	10609	517	157
1773	21656	18518†		595	179
1774	20884			596	161

Plague raging in the eaft.

The feries of epidemics in this period, meafles, influenza, and fore throat, were followed by

* This bill is ftated in the Annual Regifter at 10,506.

† In Anderfon's Hiftory of Commerce continued, vol. v. 228, the number of deaths in Paris in 1773 is ftated to have been 28,518.

dyfentery

dysentery in America from 1775 to 1777 inclusive, the mortality of which will appear from the following bills:

	Burials in				
A.D.	*A Church, Philadelphia.*	*Hartford.*	*Litchfield.*	*Trinity-church, Boston.*	*Total.*
1774	161	31	27	24	243
1775	156	74	31	48	309
1776	180	79	82	30	371
1777	222	72	120	48	462
1778	183	58	32	63	336
1779	142	49	34	35	260

It is probable the mortality in the Northern States of America was every where in that proportion. The same disease made similar ravages between 1749 and 1753—in 1759, 1765 and 6—in some places in 1769. It was remarkably mortal in 1773. This latter year was in America unhealthy. In Salem, Massachusetts, the bill of 1773 was raised to 208 (double the usual amount) by the dysentery. The bill for St. Petersburgh, in Russia, was swelled in 1773 one-fifth, and in 1777 one-fourth.

The last epidemic period, save one, was from 1781 to 1786 inclusive. The diseases were influenza, measles, and scarlatina. These were, in general, lighter than usual. In the interior of

of New York State, Vermont, Maſſachuſetts, and New Hampſhire, the ſcarlatina was more ſevere and mortal; but on the ſea-board, and eſpecially in Connecticut, it was milder, and many places wholly eſcaped it. Yet every where the bills of mortality were ſwelled in 1783, 4, 5, or 6, when the plague was raging in the Levant and Egypt. This period was cloſed by remarkably cool ſummers, and no dyſentery, or peſtilential fever of any conſiderable violence or extent, ſucceeded.

Burials in

A.D.	*Epiſcop. church, Philadelphia.*	*Trinity-church, Boſton.*	*Hartford, Connecticut.*	*Wethersfield.*	*Litchfield.*	*Guilford.*	*North-haven.*	*Total.*	
1779	142	35	49	25	34	17	11	303	Health.
1780	155	44	36	17	24	25	10	311	Health.
1781	179	41	37	20	35	17	15	344	Influenza.
1782	198	39	34	31	34	18	9	363	Ditto in Europe.
1783	232	56	42	46	42	19	8	445	Meaſles and angina.
1784	230	61	33	31	34	22	15	426	Ditto.
1785	166	41	44	24	30	18	6	329	Angina.
1786	156	49	50	37	36	19	9	356	Ditto.
1787	147	32	37	19	34	24	8	301	Health.

The ſcarlatina and meaſles produced their principal effects, it will be obſerved, in Philadelphia and Boſton. The plague raged in Egypt principally in 1783 and 4; and the ſcarlatina appeared in Britain, but without very conſiderable mortality.

Laſt

Laſt epidemic period from 1789 to 1797 incluſive.

A.D.	Burials in Philadelphia.	Epiſcopal church, New York.	Preſbyterian church, New York.	German lutheran church, New York.	Total.	
1789	1027	337	109	59	1532	Meaſles and influenza.
1790	888	310	107	52	1357	Influenza.
1791	1290	257	84	60	1691	Fever began in New York.
1792	1497	404	121	66	2088	Scarl. began. Pla. in Egypt.
1793	5304	467	101	76	5948	Scarlatina—peſtilence.
1794	1135	413	71	71	1690	SomeFevers. Temp.ſummer.
1795	2274	554	137	71	3040	Peſtilence. Hot and humid.
1796	1602	540	186	62	2390	Peſtilence—New York.
1797	1689	399	130	51	2269	Ditto—Phila. Cool ſumm.

The reſults above are not perfectly accurate, for the bills in Philadelphia, it is underſtood, are from Auguſt to Auguſt; thoſe in New York commence with the year.—The bill of the preſbyterian church in New York, for 1797, is by eſtimate; the others are taken from regiſters.

View

View of this epidemic period in Connecticut.

A.D.	Two Societies, Hartford	New Haven city.	Guilford.	Litchfield.	Wethersfield.	North Haven.	Cornwall.	Southington.	New London.	Oxford—Derby.	Total.	
1789	48	51*	10	33	35	10	6	17	58	21	299	Meafles—influenza.
1790	38	50*	20	54	36	10	10	24	81	18	341	Influenza.
1791	41	50*	21	41	20	4	6	10	60	17	170	Health.
1792	41	51	15	23	37	7	8	12	51	12	257	Health.
1793	65	70	29	80	40	18	10	20	70	11	413	Scarlatina.
1794	109	180	54	56	47	32	19	34	60	39	630	Ditto and fever.
1795	88	159	55	35	34	15	9	15	86	11	507	Dyfentery.
1796	75	67	19	40	42	12	15	27	80	14	391	Meafles.
1797	59	58	25	40	18	7	8	17	101	12	354	Healthy.

* It will be obferved, that the principal effect of the epidemics was in 1794, except in Litchfield, in the weftern part of the State.—Note, the number of deaths in New Haven for 1789, 90, and 91, is fet down by ESTIMATE, the other bills are from regifters.

View of the fame period in Bofton and the neighbourhood.

A.D	Dr. Lathrop's church.	Dr. Elliot's.	Late Dr. Belknap's.	Trinity church.	Stone chapel.	Salem.	Charleftown.	Total.	
1789	52	37	10	50	10	192	22	310	Catarrh.
1790	51	49	8	46	14	203	35	397	Ditto—meafles.
1791	34	37	8	31	16	148	26	300	Health.
1792	43	46	16	60	32	148	32	377	Ditto, except fmall-pox
1793	24	30	11	44	22	148	32	411	Ditto.
1794	45	43	12	33	22	122	26	303	Ditto.
1795	34	37	12	45	28	195	38	398	Scarlatina.
1796	37	34	16	50	28	216	65	446	Ditto—fever.
1797	37	25	10	47	22	147	49	337	Health.

Let it be noted, that the effect of the ſcarlatina was here in 1795 and 96. The progreſs of the diſeaſe is diſtinctly marked to be from New York eaſtward, from 1793 to 1796. The ſcarlatina in 1785 and 6 was moſt ſevere in Maſſachuſetts—that in 1794 in Connecticut. The bills in Boſton for 1792 were ſwelled by the ſmall-pox by inoculation, which is not to be taken into this account of epidemics. The year ſelected was rather unfavourable, as the condition of the atmoſphere was inflammatory, and inclined to produce eruptive complaints. The ſcarlatina was then making its appearance in the Middle States. The ſpring of 1793, when inoculation was begun at Hartford, was ſtill more unfavourable; and the ſmall-pox was ſo unmanageable as to ſurprize the faculty. The principles unfolded in this treatiſe will ſolve the difficulty.

By a bill of mortality for Madeira, it appears that the peſtilential principle of the years from 1760 to 64 extended to that healthy iſland.

1759	—	—	1136
1760	—	—	1356
1761	—	—	1746
1762	—	—	1366
1763	—	—	1118
1764	—	—	1325
1765	—	—	1267
1766	—	—	1037

The

The following bills for ſeveral religious ſocieties in Connecticut will exhibit a general view of epidemics from the year 1750.

A.D.	Burials in Guilford, 1 ſociety.	Hartford, 2 ſocieties.	Litchfield, 1 ſociety.	Middletown 1 ſociety.	New Haven, 1 ſociety.	Wethersfield, 1 ſociety.	Cornwall.	
1750	19							
1751	[illegible]	64						Dyſentery and angina for 3 or 4 years.
1752	28							
1753	25	29						
1754	15	20	21					Anginas.
1755	22	33	16					Anginas in ſome places.
1756	46	32	28					Dyſentery in many places.
1757	17	30	12					Catarrh.
1758	17	36	15					Meaſles.
1759	20	48	28					Meaſles, dyſentery, and fevers.
1760	29	36	24					
1761	18	42	16					Influenza.
1762	18	34	22	24				Plague, Philadelphia.
1763	18	36	16	22	13			
1764	28	42	25	25	19			
1765	15	24	22	35	17			
1766	12	46	17	29	20			Dyſentery in ſome places.
1767	20	34	22	26	15			
1768	21	17	31	30	21			
1769	43	27	19	27	31			Angina and dyſentery, meaſles.
1770	14	34	18	41	15			Angina, meaſles.
1771	10	32	35	38	18			Catarrh, angina.
1772	17	33	36	38	19			Influenza and meaſles.
1773	35	32	36	39	42			Meaſles, angina, and dyſentery.
1774	13	31	27	30	21			
1775	29	74	31	63	21	59	10	
1776	32	79	82	78	31	59	20	Angina and dyſentery very fatal.
1777	29	72	120	42	14	40	21	
1778	24	58	32	37	15	27	3	
1779	17	49	34	19	21	25	13	
1780	25	36	24	35	12	17	6	
1781	17	37	35	37	15	20	16	Influenza.
1782	18	34	34	45	21	31	8	Influenza in Europe.
1783	19	42	42	70	12	46	17	Meaſles. Angina began, but ſcarcely perceived by the burials in Connecticut.
1784	22	33	34	41	12	31	8	
1785	18	44	30	40	17	24	5	
1786	19	50	36	28	23	37	4	
1787	24	37	34	26	20	19	20	
1788	[illegible]	45	27	24	41	22	4	Meaſles, influenza.
1789	20	48	33	43	14	35	6	Meaſles, influenza.
1790	20	38	54	34	26	36	10	
1791	21	41	41	30	12	20	6	Some fevers, but no epidemic.
1792	15	41	23	24	11	37	8	
1793	29	65	80	35	12	40	10	Angina, fevers.
1794	54	109	56	28	50	47	19	Angina, fevers.
1795	55	88	35	16	38	34	9	Fevers.
1796	19	75	40	35	8	42	15	Meaſles in many places,
1797	25	59	40	25	14	18	8	Health in general.

From the bills of mortality and preceding hiſtory may be deduced ſome intereſting obſervations.

1. We obſerve an order and progreſſion in the epidemics, which is in a degree uniform. Periods of peſtilence, with ſome exceptions, ſeem to be introduced by meaſles and influenza: then follow diſeaſes of the throat, or anginas; laſtly, peſtilential fevers. During the whole period, the meaſles, influenza, and angina, occaſionally appear in ſpring, autumn, and winter; and rarely, if ever, does a peſtilential fever, as plague and yellow fever, occur in a particular city or country, without influenza, angina, meaſles, or inflammatory fevers, in the ſpring preceding, for immediate precurſors. This is true in the tropical climates, in caſes of epidemics; and ſo uniform has been the fact in temperate latitudes, that I am nearly prepared to ſay, that if none of thoſe precurſors appear in winter and ſpring, no peſtilential fever will be epidemic in the following ſummer and autumn, unleſs the dyſentery may be excepted. It holds true in every caſe of *great* peſtilence.

2. The progreſſiveneſs in the peſtilential principle is obvious in the augmented bills of mortality which immediately precede the plague. This ariſes from the number and violence of the malignant diſeaſes which always precede an epidemic peſtilence. This augmentation is

visible sometimes two years before the plague appears, and almost always in the spring months preceding. See the London bills in the years preceding the plague in 1625, 1636, 1665. The same is observable in other bills, both in Europe and America. In a few instances the bill of the preceding year is low; but in this some other epidemic has usually gone before, and finished its course, or the plague is preceded by influenza only, which does not swell the bill of mortality.

3. Sometimes a series of epidemics falls with more violence on one hemisphere than on the other; but, perhaps, in no instance has a course of diseases spread over one continent without showing themselves on the other. I have not been able to find an instance in which the plague has made great ravages in the east, except when the American continent has been more or less affected by the epidemics abovementioned; and, in some instances, it is proved that the violence of the sore throat, influenza, measles, or yellow fever, in America, has corresponded with the violence of pestilence in Egypt and the Levant. The commencement of each period of epidemics is nearly contemporary in both hemispheres*.

* It sometimes happens that pestilence occurs in Constantinople. Smyrna, or Cairo, when it is not epidemic beyond those cities, owing to peculiar seasons and local causes. But

Thus a great plague in Conſtantinople was contemporary with the fatal angina and dyſentery in America in 1751—alſo in 1755. Contemporary with the meaſles in America, in 1758 and 9, was the commencement of the extenſive Levant plague of 1760. Peſtilence in Perſia was contemporary with the epidemics of 1773. In 1783 commenced plague in the eaſt, and epidemics in America. The ſame in 1792 and 3.—Diſeaſes of the throat, in almoſt every inſtance, prevail at the ſame time in Europe and America.

4. In two periods within half a century a ſevere angina and dyſentery have been epidemic together, and once for a ſeries of years, as in 1751, and from 1773 to 1777. This is an exception to the uſual order, and other deviations ſometimes occur.

5. As catarrh precedes, ſo it follows every ſevere epidemic peſtilence; and the perſons who have been affected with a peſtilential fever in ſummer are more apt to be affected by catarrh at the commencement of cold weather.

6. After ſome peſtilential fevers in ſummer, the inflammatory fevers of winter wear the

But it never ſpreads to Syria, the iſlands of the Archipelago, and other neighbouring countries, except when epidemic diſeaſes ſpread over the world; at leaſt, I have not found an inſtance.

 livery

livery of the ſummer fevers. They generally carry with them bilious diſcharges and a yellow ſkin. They have alſo this remarkable character, that they ſpeedily run through the inflammatory diatheſis, and become typhus. They are the *peſtilence of winter*; and ſometimes appear *before* the *peſtilence of ſummer*. This fact alone decides the queſtion, that peſtilential fevers of ſummer are generated on the ſpot where they exiſt, and derive their malignant and infectious quality ſolely from the ſtate of the elements.

This ſpecies of inflammatory fever has occurred in many caſes, during the winter months, ſince the year 1790. In ſome caſes it has extinguiſhed three, four, and five members of a family, as in Hartford and New Haven. But it is a moſt conſoling reflection, that it is leſs frequent than formerly in this country. It has not been epidemic in the northern ſtates ſince 1761, as far as I can learn. Formerly it was as frightful a calamity as the yellow fever is in this age. In the foregoing hiſtory many examples have been mentioned—as at Fairfeild in 1698—at Waterbury in 1713—at Hartford and Duck Creek in 1720—at Farmington in 1729—at Bethlem, Hartford, Eaſt Haven, and New Haven, in 1761—at Holliſton in 1753, &c. —Whether the diſappearance of this diſeaſe is owing

owing to the clearing of the country, by which the quantity of debilitating miafmata of fummer has been diminifhed, or whether it is the confequence of other alterations in our climate, is not eafily determined.

The difappearance of the long fever, fo called, is another moft confoling circumftance. This fpecies of typhus fever was formerly one of the moft terrible difeafes of our climate. At prefent it is a rare occurrence.

On the whole, we have very clear proof that the *quantity of difeafe* in this country has been diminifhed within half a century. The yellow fever, that is, the peftilential fever of fummer and autumn, was formerly as frequent, and as malignant, as in this age; while the inflammatory fevers of winter, and the long fever, have almoft difappeared as epidemics. The intermittents and remittents of autumn are greatly decreafed in the northern ftates; and the dyfentery has not increafed in frequency or virulence. Anginas have never been fo fatal as they were between 1735 and 1743.

It is probable that fome of thefe changes in the character of difeafes may be afcribed to alterations in our climate, or modes of living, and therefore may be permanent. In fome cafes, improvements in medical fcience and the practice of phyfic may have difarmed dif-

eaſes of their terrors. But it is poſſible that ſome of the changes mentioned are only revolutions in diſeaſe, occaſioned by temporary cauſes; and that the ſame diſorders may, in future periods, recur, with the whole train of formidable ſymptoms.

SECTION XII.

Of the Influenza or Epidemic Catarrh.

As the catarrh appears to be the difeafe which is moft clofely connected with peftilence, and the leaft dependent on local caufes, or the fenfible qualities of the air, I have collected all the well defined inftances of this epidemic which have occurred to my refearches, and arranged them in chronological order; placing againft the year the moft remarkable phyfical occurrences, and mentioning thofe which fell within the years next preceding and following.

A. D. *Catarrh epidemic in*

1174. The year *before* an eruption of Etna, and followed by great mortality.

[Chafm in our accounts of this difeafe.]

1510. The *fame* year with an eruption in Iceland, and after great earthquakes; the air humid; a comet the next year.

[Chafm.]

1551. The year *after* an eruption of Etna and a comet. Seafon wet.

1557. The year *after* an eruption of Etna. Seaſon moſtly wet, but in ſome countries dry. A comet the ſame year.

[Chaſm.]

1580. The year *after* an eruption of Etna. Cool, dry, north wind. A comet.

1587. The *ſame* year with an eruption in Iceland, and year after a comet.

1591. The year *after* great earthquakes and a comet.

1597. The year *after* great earthquakes and a hard winter. A comet the ſame year.

1602. The year *after* earthquakes, an eruption in South America, and a ſevere winter. Cool, wet ſeaſon.

1610. The year *after* an eruption of Etna; a comet and a ſevere winter. Seaſon very hot and dry.

[Chaſm.]

1647. Firſt catarrh mentioned in American Annals. A comet and violent earthquakes in South America.

1650. In Europe, the *ſame* year with an eruption of Etna and earthquakes.

1655. In America, the *ſame* year with great earthquakes in South America, and an eruption of Veſuvius.

1658. In Europe after a ſevere winter. Summer cool.

1675.

1675. In Europe, while Etna was in explosion. Mild winter.

1679-80. In Europe, at the close of 15 years eruption of Etna. Wet season and a comet.

1688. In Europe, the *same* year with an eruption of Vesuvius after a severe winter, and earthquakes; began in a hot summer.

1693. In Europe, the *same* year with an eruption in Iceland, and great earthquakes. Cool summer.

1697-8. In America, after a great earthquake in Peru. A comet and severe winter,

1699. In Europe, the *same* year with great earthquakes and a comet,

1708-9. In Europe, the year *after* a comet and volcanic eruption; in a severe winter.

1712. In Europe, the *same* year with an eruption of Vesuvius, and a comet. A wet season.

1717. In Europe, the year of a comet, an eruption of Vesuvius and a severe winter.

1729. In Europe, the *same* year with an eruption in Iceland and of Vesuvius. A dry summer. A comet.

1733. Universal, after a cold winter, a comet and great earthquakes.

1737. Universal, the *same* year with an eruption

tion of Vefuvius; great earthquakes and a comet.

1743. In Europe, violent earthquakes.
1744. A comet; earthquakes.

1755. In Europe, in the *fame* year with violent earthquakes, and eruptions of volcanoes. Severe winter in Europe.

1757 In America, foon after a comet, and followed by an earthquake.

1758. In Europe, with a meteor; earthquakes the next year.

1761. In America; an earthquake at the fame time.

1762. In Europe; a comet the fame year, followed by an eruption of Etna the next year. Dry fummer in America.

1767. In Europe, the *fame* year with an eruption of Vefuvius; and the year after other eruptions and earthquakes.

1771. In America, in the years with volcanic
1772. eruptions. Cold winter in 1772.

1775. In Europe, preceded by earthquakes; fmall eruption of Lipari the *fame* year, and in New Spain.

1781. In America, the year *after* an eruption of Etna, and a moft rigorous winter.

1782. In Europe and Afia; cold fummer; very dry in America; the year *before* a great eruption of Heckla.

1788.

1788. In Europe, ſoon *after* eruptions of Veſuvius and Etna. A comet.
1789. In America, contemporary with an eruption of Veſuvius; juſt after great earthquakes in Europe and Iceland, and a hot ſummer.
1790. In America, after a mild winter.
1795. In Europe, the winter *after* a great eruption of Veſuvius.
1797. In Europe, the *ſame* year with a comet and earthquakes.

The accounts of the ſeaſons are moſtly from Engliſh writers, and refer to England, with ſome exceptions. In regard to heat and cold, the ſeaſons are generally uniform in moſt countries on the ſame continent, but not in regard to drought or moiſture.

Of theſe forty-four inſtances of influenza, it may be obſerved from the preceding hiſtory,

1ſt. That moſt of them happened after or during ſevere cold, or during moiſt weather, and in ſpring, winter, or autumn. Some, however, happened in dry, hot ſeaſons; and others in mild winters.

2d. Eighteen inſtances occurred in years when there was a volcanic eruption in Italy or Iceland; and eleven others, though in different years, were within a few months of eruptions; making twenty-nine out of the forty-four,

3d.

3d. Almoſt all happened in years of great earthquakes, or within a few months preceding or following them.

4th. Twenty-nine inſtances occurred within a year, or a few months preceding or following the approach of comets.

It is further to be obſerved, that ſome of theſe epidemics have been limited to the American hemiſphere, at the diſtance of three, four, or five years from an epidemic of the ſame kind in Europe. Such as thoſe of 1647, 1655, which coincide in time with violent earthquakes in South America.

In other inſtances, this epidemic ſpreads over the whole globe, uſually beginning in America, according to the information yet obtained. Thus, in four inſtances, viz. 1698, 1757, 1761, 1781, it ſpread over the American hemiſphere one year prior to its invading the other hemiſphere; and the univerſal catarrh of 1733, which encircled the globe, commenced in America two months before it did in Europe. The epidemic of 1782, invaded Europe, from the ſide of Aſia, the year after it appeared in America. The influenza of 1788 in Europe, *preceded* the ſame diſeaſe in America—the only inſtance I have found.

I regret my want of materials to complete a view of this ſubject. No regular regiſter has been kept in America of the ſeaſons, diſeaſes, and

and phenomena, from the firſt ſettlement; and, whether any notices of all the catarrhs in this country are in exiſtence, I do not know. I have found no account of any between 1655 and 1698; nor between the latter year and 1733. From 1737 to 1757 is alſo a chaſm. One of theſe inſtances, that of 1698, came to my knowledge by accident, as I have mentioned under that year in the foregoing hiſtory. From the uniform appearance of this epidemic, as often as once in ten years, in periods of which we have correct regiſters, we have grounds to preſume it has always occurred in nearly the ſame periods.

This epidemic is evidently the effect of ſome inſenſible qualities of the atmoſphere; as it ſpreads with aſtoniſhing rapidity, over land and ſea, uncontrolled by heat or cold, drought or moiſture. From theſe circumſtances, and its near coincidence in time with the violent action of fire in earthquakes and volcanic diſcharges, there is reaſon to conclude the diſeaſe to be the effect of ſome acceſs of ſtimulant powers to the atmoſphere by means of the electrical principle. No other principle in creation, which has yet come under the cognizance of the human mind, ſeems adequate to the ſame effects. I do not conſider the earthquakes and volcanic eruptions as the *cauſes* of this epidemic,

mic, but as *effects* of the common cause and evidences of its existence.

The courses of this epidemic are very various: That in 1510 proceeded from Africa to Sicily, Italy, and the north of Europe. That epidemic could not be the effect of the eruption in Iceland, for it appeared first in southern latitudes. If there was a volcanic discharge, about that time in Africa, we might be led to ascribe the disease to that cause; but it is more probable that we ought to ascribe it to an insensible operation of atmospheric fire*, which is more general and violent about the time of eruptions; and which fire is probably agitated in all parts of the globe, although it produces visible explosions only in particular places. I think no man can question the fact, after reading the preceding history.

The course of the epidemic catarrh of 1551, I am not able to ascertain; nor that of 1557; but the latter invaded Spain in August.

The severe influenza of 1580, began in the south of Europe in the heat of summer, and proceeded to the north. The season, in general, was temperate.

* I use this word to express the principle manifested in electrical operations, although this is usually supposed to be a cold fusion, or substance destitute of heat. Of the nature of this principle we know little, and this only by its effects.

From

From that year to 1708-9, I find no account of the courſe of the epidemic catarrh; but the latter began in the north of Europe, and proceeded to the ſouth.

The epidemic of 1729-30, proceeded from Poland and Sileſia to the weſt and ſouth of Europe, and ended about the time of an exploſion from Veſuvius.

The univerſal catarrh of 1733, began in America in the autumn of 1732. It appeared in Europe in December. That of 1788 appeared at different places in April, May, June, and Auguſt.

The epidemic in America in 1789, began in the middle ſtate, and ſpread ſouthward and eaſtward. In 1790, it began in about the ſame longitude, but in the interior country, and ſpread eaſtward and ſouthward.

The influenza of 1782 in Europe, came from Aſia, poſſibly it might have travelled from America, acroſs the Pacific to China and Kamſchatſka, as it was epidemic in America in 1781.

This is all I am able to diſcover of the origin and direction of this ſingular epidemic. It is greatly to be deſired, that we might learn preciſely the dates of its appearance, the place, the direction of its progreſs, in all caſes, and compare theſe circumſtances with the extraordinary agitations of the elements, which oc-

cur about the ſame time. But for this purpoſe, my materials are incomplete.

It is obſervable, however, that the influenza is cloſely allied to the meaſles. Sometimes, the ſymptoms are combined in the ſame attacks; and rarely does one diſeaſe become epidemic, except juſt before or after the other. This proves their alliance; indeed, I conſider them as different modifications of the ſame epidemic.

Catarrh is alſo cloſely connected with peſtilential fevers, and, ſometimes, this is true of the meaſles. It is rare, indeed, that epidemic plague and yellow fever do not begin and end in catarrhal affections; that is, catarrh precedes in ſpring, and follows in autumn. Sometimes, peſtilence is preceded and followed by meaſles and angina.

Every epidemic conſtitution ſeems to commence with meaſles or influenza. To theſe ſucceed angina, in ſome of its various forms, which are all the offspring of the ſame parent. Then follow peſtilential fevers, in the form of dyſentery, yellow fever and plague. Whenever the epidemic conſtitution is manifeſted by meaſles, influenza and affections of the throat, common diſeaſes, even in places apparently healthy, become more malignant; and ſporadic caſes of peſtilential fever occur in almoſt every ſituation.

It

It is remarkable, that the extent and violence of the influenza mark very nearly the ſeverity of the peſtilential fevers which precede and are to follow it. The two epidemics of 1733 and 37, invaded the whole globe in the ſame year; they were very ſevere, and ſo were the anginas and plagues of that period; beyond what has occurred at any other time during this century.

Since finiſhing the foregoing hiſtory, I have learnt ſome further particulars reſpecting the catarrh of 1737. From two elderly gentlemen, who were then arrived to adult years, I learn that this influenza invaded Connecticut in the month of November. If this is correct information, the diſeaſe appeared in the two hemiſpheres about the ſame time, an exception to the uſual order of the epidemic.

Dr. Warren mentions this catarrh in the winter of that year, in the Weſt Indies. It was the *immediate precurſor* of the violent fever in Barbadoes in 1738, which that author has deſcribed, and if I do not mis-remember, has *imported* into that iſland!! It was alſo the immediate precurſor of that peſtilential fever which, in the ſame ſummer, threatened Mexico with depopulation.

This epidemic was ſo ſevere, general, and ſudden, in its invaſion, that neighbours, in Connecticut, could not viſit each other; and it

left in health ſcarcely people enough to perform the ordinary domeſtic labours neceſſary to ſupport life.

It will be obſerved, that this epidemic coincides in time with a great eruption of Veſuvius, and one of the moſt tremendous gales in the Eaſt Indies recorded in hiſtory.

Short mentions univerſal catarrh in Europe in 1747, but not ſevere. This correſponds with an eruption of Etna. See vol. ii. 164, 321.

SECTION XIII.

Of the Order, Connection, and Progression, of pestilential Epidemics.

IN the early periods of the world, little notice appears to have been taken of a connection between epidemic diseases; nor have modern writers supplied this defect in the history of medicine. Hippocrates and Sydenham seem to have been aware of such a connection; and the latter author has laid a broad and firm foundation for a complete system of truth on the subject of epidemics. His observations were confined to the city of London. Had he extended his view to all parts of Europe, and generalized his observations, he would have found a multitude of facts to justify his theory; and probably would have raised it above the reach of that obloquy and ridicule which succeeding professors of physic of less genius and learning have cast on his occult qualities of air.

Indeed, it is surprizing that medical men have not pursued the ideas suggested by these

great fathers of their ſcience. Hippocrates led the way, unlocking the great doctrine of a conſtitution or ſtate of the atmoſphere, calculated to produce particular epidemic diſeaſes; a doctrine which Sydenham has purſued with wonderful ſucceſs. Any man who reads the hiſtory of diſeaſes, muſt ſee that certain ſpecies of them appear nearly together in time and place. The order in which they appear may not be exactly the ſame at all times, and in all countries; but they occur ſo nearly together as evidently to prove their alliance, and their dependence on the ſame general cauſes.

All popular diſeaſes muſt have for their cauſes ſome principles as extenſive as the effects. Theſe cauſes, moſt probably, exiſt in the elements, fire, air, and water; for we know of no other medium by which diſeaſes can be communicated to whole communities of people.

Bad food, indeed, is a fruitful ſource of diſeaſes; but this muſt always proceed from the qualities of the elements which enter into its compoſition. A defect, therefore, in the nouriſhing powers of food, is a conſequence of a defect or ſuperabundance in the elements, or in their combination in animal and vegetable productions. It may be conſidered as a diſeaſe in the animal and vegetable kingdom, which moſt probably proceeds from the ſame cauſes as epidemic diſtempers among mankind.

The

The principal epidemic diſtempers which invade mankind are catarrh or influenza, meaſles, whooping or chin-cough, the different ſpecies of angina, ſmall-pox, bilious fevers, petechial fever, dyſentery, plague. Of theſe, catarrh is the moſt decidedly an epidemic, dependent wholly on a particular ſtate of atmoſphere. Cullen calls it "catarrh from contagion," to diſtinguiſh it from ſporadic caſes of the ſame diſeaſe; but, after careful obſervation, during the progreſs of it in the United States in 1789, and again in 1790, I am confident the progreſs of the diſeaſe depends very little on a communication from perſon to perſon. It is doubtful whether it is an infectious diſeaſe; and I have ſtrong evidence to prove it not ſo; but certain it is, that its ſudden invaſion of whole families, whole towns, and even whole countries, and the rapidity of its progreſs over ſea and land, abſolutely preclude the ſuppoſition of its dependence on ſpecific contagion.

The other diſeaſes above enumerated may ariſe from both cauſes—infection, and a peculiar ſtate of air. Some of them depend moſtly on a conſtitution of air fitted to produce them; others are ſeldom produced without a connection with diſeaſed perſons. It is, however, proper to obſerve, that the ſmall-pox, dyſentery, and plague, are not uſually, and in ſtrictneſs of language, *epidemic* diſeaſes. They ſeldom

invade whole countries. They are more properly *endemic*; yet this epithet is not ſtrictly applicable to them, being uſed more properly to denote a diſeaſe which is *peculiar* to a particular place, whereas thoſe diſeaſes may invade any place on the globe. The elephantiaſis is an *endemic* in Egypt, and certain other places in warm climates; the ſmall-pox, dyſentery, and plague, uſually appear in cities, camps, or other unhealthy ſituations, without affecting neighbouring places which contain not the ſame local cauſes of diſeaſe. They might, therefore, in ſtrict propriety, be denominated *temporary endemics*, in oppoſition to *epidemics* which ſpread to all places alike; and to *endemics*, which *conſtantly* or *uſually* appear in particular parts of the world.

This diſtinction, however, is not very material; and I ſhall therefore ſpeak of the ſmall-pox, dyſentery, and plague, as *epidemic* diſeaſes; meaning by this epithet, that they, at certain times, ſpread generally over a particular town or region.

The nature and kinds of contagion will be more particularly conſidered in a ſubſequent ſection; the preſent ſubject is the order, connection, and progreſſion, obſervable in peſtilential epidemics.

The influence of a certain ſtate of air in generating epidemics was obſerved by Hippocrates,

who

who has defcribed the prevalent difeafes in different feafons. In his fecond fection on epidemics he defcribes what he calls "katastafis loimodes," a peftilential ftate of the air or feafons. He does not, indeed, in this paffage mention the *plague*; but he fpeaks of thofe malignant difeafes which are, in modern times, the precurfors of the plague, and which are now produced by the ftate of weather which he defcribes.

This ftate of the feafons he reprefents thus—"The year was auftrinus, remarkable for foutherly breezes, rainy, and without winds. The firft part of the year dry, and autumn rainy, with foutherly winds, humid, and cloudy. In winter, foutherly winds, moift and mild weather. About the vernal equinox, fevere cold; but the north winds, with fnow, were of no long duration. Spring was again calm; foutherly weather; great rains continued till Auguft, then clear hot weather: the cool Etefian winds blew but little, and for fhort periods; a rainy autumn, with north winds."

The foutherly, hot, humid air here defcribed, whenever of long continuance in fummer, proves the caufe of numerous malignant difeafes in the United States, as well as in Europe, although not certainly productive of peftilence.

Hippocrates proceeds to mention the difeafes which prevailed in this ftate of feafons. "Before fpring, even during the cold weather, ap-

 peared

peared many eryſipelous diſeaſes of a malignant type. Diſeaſes of the fauces, accompanied with hoarſeneſs; ardent fevers, with phrenitis; ulcers in the mouth, inflammation of eyes, carbuncles, &c. Theſe diſeaſes ſpread and became epidemic." The author then proceeds to deſcribe the eryſipelas and other diſeaſes here named. Theſe caſes differ from the plague in Athens; and prove that the peſtilence in Thaſus, where he wrote, was of milder ſymptoms, though probably contemporary with that epidemic in Athens.

My particular reaſon for reciting theſe paſſages from Hippocrates is, to prove a progreſſiveneſs in a peſtilential ſtate of air, and the diſeaſes which it produces. The diſeaſes here mentioned are the ſame, ſubſtantially, as thoſe which *precede* the plague in modern times, in the countries bordering on the Mediterranean, and with little variation, the ſame with thoſe which precede the plague in all parts of the world. Eryſipelous, or other eruptive diſeaſes, catarrhous affections, or ardent fevers, are the conſtant precurſors of the plague wherever it appears. Hippocrates does not mention any fatal plague, in the ſtate of air deſcribed; and it often happens, at this day, that the ſtrength of the peſtilential principle is arreſted in its progreſs, and the epidemics are limited, in their violence, to diſeaſes of a type leſs malignant

nant than the true plague, or arising to the plague only in a few scattering cases. But whatever may be the degree of the pestilential state of the air, or at whatever point it may be destined to cease, and yield to a more salubrious constitution, the class of diseases which mark its rise and progress, are always similar, or the same, modified only in the violence of their symptoms by accidental circumstances.

A careful attention to these facts cannot fail to convince the observer of the justness of Sydenham's doctrines in regard to constitutions of air; and the facts themselves demolish, at one stroke, all the common medical doctrines of the communication of pestilence from place to place by contagion or femites.

Unfortunately, the histories of ancient plagues furnish but little light on this subject; yet the barren annals of antiquity and the middle ages are not wholly destitute of evidence to this point. The progression of the plague in Rome, which grew more general and fatal to the second and third year, is a fact recorded by Livy, and is related in the preceding pages.

The remark of Dion Cassius, that the ashes from Vesuvius, in the great eruption of 79, produced that year only slight diseases, but the next year an epidemic, has already been noticed. It leaves us no room to question, that the destructive plague of the year 80 was preceded

preceded by epidemic diforders of a lefs malignant type.

The middle ages furnifh facts in confirmation of this doctrine. Witnefs the great plague in 1112, which was preceded by eryfipelous difeafes in England in 1109, and great mortality in 1111: the plague of 1242, which was preceded by great mortality in 1240. The fame fact is obfervable in the peftilence of 1252, 1368, 1379, 1390, 1517, 1527, 1575, 1636, and in many other inftances.

This fact did not efcape the notice of that accurate obferver of nature, Lord Bacon, who lived at a period when the plague frequently infefted England. He fays, "The leffer infections of the fmall-pox, purple fever, agues, &c. in the preceding fummer, and hovering all the winter, *portend a great peftilence the following fummer*, for putrefaction rifes not to its height at once."

Works, vol. iii. page 59.

That ftate of air which produces peftilential difeafes, Lord Bacon denominates *putrefaction*; but whatever appellation we may give to the *caufe* of peftilence, the remark is demonftrably well founded, that this "rifes not to its height at once." It is progreffive; producing firft the "leffer infections." The plague is rarely, if ever, an original, diftinct, ifolated difeafe; but the

the laſt, or moſt mortal form of a ſeries of malignant diſtempers. The *purple* fever, mentioned by Lord Bacon, is nearly allied to the *petechial* fever, which is the uſual precurſor of peſtilence in the Levant.

The univerſal plague of 1635, 6, and 7, was preceded by the uſual diſeaſes, and the progreſs of them is diſtinctly traced by the learned Diemerbroeck. He remarks, Chapter 3, *de peſte*, that " the ſpring of 1635, was warm and moderately humid, to which ſucceeded a very hot, dry ſeaſon, in which appeared many malignant epidemics. In the firſt place, a ſevere plague broke out at Leyden, and deſtroyed more than 20,000 lives. At Nimeguen, in Gueldres, and other regions, a certain peſtilent fever ſpread with dreadful mortality. In autumn, the ſevere heat ſtill continuing, with exceſſive drought, many other malignant diſeaſes appeared, as ſmall-pox, meaſles, diarrhœa, and dyſentery, of a very bad type; but above all, the above-mentioned peſtilential purple fever, called in Italy *petechial*, increaſed daily in extent and violence, *until it turned into the true plague*—" *donec tandem in apertiſsimam peſtem tranſiret.*"—The author goes on to remark, that from November, through the winter, ſcattering caſes of plague occurred in Nimeguen. In January 1636 it increaſed, and in March ſpread and became epidemic; roſe

rofe to its height in April, and continued till October.

See pages 5 and 6.

This paffage contains a number of important facts. Firft, The feafons were infalubrious. Secondly, The peftilential ftate of air extended to many places at the fame time. In another page, the author fays, the peftilence fpread over almoft all Germany and the Low Countries. Thirdly, This ftate of air was of different degrees of malignity or violence, in different places, at the fame time: thus the plague appeared at Leyden early in 1635, but contemporary with this was the appearance of the purple fever in Nimeguen and in other places; and during the fummer and autumn, this, and other epidemics, continued to rage with great mortality, and, at laft, the ftrength of the peftilential principle increafing, the fever changed its form, and appeared in the true plague.

Now, the modern way of accounting for the plague in Nimeguen would be, to *allege* or *fuppofe* fome infected goods to have conveyed the contagion from Leyden, where it firft appeared; and then to fuppofe, the infection to be carried to Leyden from the Levant.

The philofophic Diemerbroeck, who was prefent and obferved all the circumftances, *fuppofes* nothing. He relates plain facts juft as they occurred,

occurred, and admits that the plague muſt have originated in the country.

By conſidering the malignant epidemics that prevailed at that time as connected, and depending on the ſame general cauſe, we ſolve all the difficulties attending the origin of the plague. The petechial fever, which appeared at Nimeguen and other places in 1635, was *one of the forms* in which the general contagion of the period exhibited its effects on the human conſtitution. It was a *part* of the peſtilence—it could not be conveyed from Leyden, for it appeared in moſt parts of the Low Countries and in Germany at the ſame time. The ſame general cauſe, or indiſpoſition in the elements to ſupport healthy life, produced various peſtilential diſeaſes, according to place, ſeaſon, age, habit of body, and conſtitution, until its ſtrength and violence aroſe to their height, and gradually introduced the worſt form of peſtilence.

The idea of Diemerbroeck, that the purple fever " turned to the plague," muſt give great offence to the followers of Mead and Cullen, the advocates for the doctrine of the propagation of the plague ſolely by ſpecific contagion. It oppoſes, efficaciouſly, their whole theory, and levels it with the earth.

The fact is, however, indiſputable. In the diſtreſsing period from 1569 to 1577, when Europe

Europe was almoſt depopulated by the ſpotted fever, phyſicians obſerved that this diſeaſe frequently turned into the plague, and the plague into the ſpotted fever. The ſame fact was often noticed by writers of the 16th and 17th centuries, in which the plague frequently over-ran Europe. Theſe two diſeaſes are, therefore, two diſtinct forms or modifications of peſtilence—probably bearing an affinity to each other, like that between the diſtinct and confluent ſmall-pox. This fact ſhows, that the diſtinction made by medical writers, between *peſtis* and *peſtilentia*, the plague and other peſtilential diſtempers, however uſeful in practice, is not authorized by truth and philoſophy. The ancients claſſed all contagious epidemics together, and denominated them *peſtilence:* and this diſtribution, in regard to their cauſes and origin, was doubtleſs moſt philoſophical. The diſtribution made by modern phyſicians ſeems to have ariſen out of differences of ſymptoms, and to be beſt adapted to practice. At the ſame time, it has probably been the occaſion of the common error of conſidering different ſpecies or forms of peſtilence as diſeaſes of generical difference, and proceeding wholly from diſtinct cauſes, when, in fact, they all have *one general cauſe* in common, and the varieties of their ſymptoms proceed from *diſtinct, local, and temporary cauſes.*

On

On this ſubject the learned Riverius, in his Praxeos Medicæ, lib. 17, has many judicious remarks. He obſerves, "That authors, who write on fevers, diſtinguiſh a peſtilent from a malignant fever: by peſtilent fever they underſtand the true plague; by a malignant one, the fever vulgarly called *purple* or other fever, which, though epidemic and contagious, is leſs dangerous, and in which more patients ſurvive than periſh; whereas the eſſence of the true plague conſiſts in this, that it deſtroys more than half who are ſeized with it." He, however, conſiders theſe fevers as differing moſtly in degree of malignity, and therefore treats of them under one head.

A peſtilent fever this author conſiders as not proceeding ſolely from intemperate heat or putridity, but from a malignant and poiſonous quality; and whenever this quality appears in a fever, whether quotidian, hectic, or putrid, he thinks it ought to be denominated *peſtilent*. A peſtilent fever differs from the plague as ſpecies from genus, becauſe there may be plague without fever.

This author remarks alſo the connection between certain epidemics. "Many deadly diſeaſes accompany the prevalence of peſtilence, as phrenitis, anginas, pleuriſies, peripneumonies, inflammations of the liver, dyſenteries, and many others." He aſcribes epidemics to the ſtate of

air as a common caufe, to which he adds the ufual local or particular caufes, which modify its influence.

Profper Alpinus informs us that thefe difeafes prevail alfo in Egypt at certain times; but he gives no account of their order or connection.

Vol. ii. p. 73.

Bellinus defcribes the phenomena which precede the plague, which he calls its *antecedents*. After mentioning food of a bad quality, impure air from exhalations, intemperate feafons, vapours emitted during earthquakes, and the like, he fays, "*Mox autem invafuram antecedunt morbi epidemici, qui cujufcunque generis effe poffunt, febres petechiales, variolæ, morbilli, dyfenteria, pleuritides epidemicæ.*"

De Febribus, page 265.

This author does not here fpeak of thefe antecedents as *unufual* phenomena; but lays it down as a general fact, that fpotted fevers, fmall-pox, meafles, &c. become epidemic juft before the invafion of the plague.

Van Helmont obferves, that "he could never perceive a different pulfe in the plague from that in continual malignant fevers," p. 1138.—No inconfiderable authority for the identity of the difeafes in kind, however various in degree.

The

The great Sydenham took notice of the unusual prevalence of malignant distempers just before the plague of 1665. In vol. i. p. 122, he says, "I never knew pleurisies, quinsies, and other inflammatory diseases, more common than they were for some weeks preceding the plague in London in 1665."—These were the hybernal and vernal precursors of pestilence. As the season advanced, and the weather became mild, these inflammatory diseases yielded to a malignant fever, described by the same author, and already mentioned in the preceding history, which was the immediate precursor of the true form of the plague, into which it changed by such insensible degrees, that Sydenham himself was at a loss to determine whether that fever was the plague or not, and was candid enough to acknowledge his ignorance. And as a further proof that this fever and the plague were only different forms of the same disease, we must notice the fact recorded by Sydenham, that when the plague in autumn began to abate, the same malignant fever re-appeared—see page 136—that is, the disease, by change of seasons, began to lose its glandular marks, and gradually to assume a less malignant type. Hodges mentions the same fact, and so does Morton.

In every instance of a severe plague, of which I can obtain a tolerably correct history, the disease has passed through a similar progression, and exhibited similar facts.

Thus in 1719, the year before the great plague in Marseilles, appeared a pestilential fever in that city, which, in some cases, produced buboes and carbuncles; that is, the plague actually began to appear six months before the arrival of the infection from Syria!

In Aleppo, the plague, which appeared in 1742, was *preceded* by an acute fever; and, after the disease abated in July, appeared diarrheas and dysentery of a malignant type, attended, in many cases, with petechiæ; and intermittents, which often proved fatal. These diseases, in their acute forms, prevailed also with the plague, which in this year was not severe, nor wholly the predominant epidemic.

This continued acute fever, and pleurisies, ran through the winter. In November appeared a few cases of the plague. Where the *infection* had been dormant, from July to November, the author of this account, Alexander Russel, has not informed us.

In the spring of 1743 the plague again appeared, and spread in the city; and at the usual time in summer subsided, being again succeeded by other acute disorders, which, by bleeding and purging, were formed into tertians, double tertians and quotidians.

Here again we have the same progression in the state of pestilence, which had been remarked by Hippocrates, Bacon, and Sydenham. During the

existence

existence of this pestilential constitution in Aleppo, all the ordinary diseases of the country assumed a more malignant type; or, as Sydenham remarked of the diseases which preceded the plague of 1665, they "differed from the same diseases in other years by new and unusual symptoms, which, in short, amounted to this, that they were all *more violent*."

See vol. i. page 26.

The diseases changed their form with the seasons—the acute fever preceding ran into plague, and plague ran into malignant dysentery, tertians, and other acute distempers.

Similar facts are observed in America. The plague has been preceded by acute diseases, as anginas, remittents of a bad type, &c. and followed by remittents, dysentery, and malignant pleurisy.

The dreadful plague at Messina in 1743, which destroyed two thirds of its inhabitants, was introduced by a malignant fever. One physician alone, out of thirty-three, pronounced it the plague; the others denied it, because the disease was not attended with glandular swellings.

A similar fever preceded the severe plague at Venice in 1576; and the same uncertainty at first embarrassed the physicians and magistracy.

The terrible pestilence at Naples in 1656 was announced by the usual herald of the disease, a

malignant fever. One phyfician alone pronounced it the plague, and for his audacity was imprifoned by the Viceroy.

The extenfive peftilence, which fpread over all the Levant countries and iflands from 1759 to 1763, was every where preceded by a fimilar increafe of malignant difeafes, and efpecially by the petechial fever, which appeared, at Aleppo, in the year next previous to the plague. Yet the author of this account, Patrick Ruffel, labours very gravely to trace the difeafe to Turks from Egypt, and their old clothes.

The uncertainty among phyficians, at the commencement of a plague, with refpect to the nature of the diforder, is a ftrong proof of the doctrine for which I contend. Van Helmont, Diemerbroeck, and others, have found it neceffary to lay down rules, with a great degree of care and caution, to enable themfelves to determine whether a malignant difeafe is the plague or not. Van Helmont obferves, p. 1138, that he could perceive no difference in the pulfe in plague and continual fevers of the malignant kind—that buboes in the groin, paroitides, &c. are not unfrequently found in fevers free from plague, and fometimes fpots and carbuncles.— "But," fays he, "if many of thefe appearances do concur, there is no difficulty in pronouncing it the plague, efpecially if they appear before or early after the fever."

Diemerbroeck

Diemerbroeck declares, that no one symptom determines a disease to be the plague—neither fever, buboes, nor carbuncles, are essential to that disease, for it often passes off without either—many of its symptoms are common to that and other distempers: the existence of the disease, therefore, is to be determined by a view of all the circumstances; and one criterion, he remarks, is, the prevalence of the plague in neighbouring towns.

This last remark indicates that the author had observed the existence of pestilence in various places at the same time to be a common event.

The difficulty, at first, in ascertaining the existence of the plague, proceeds wholly from the progression in the series of diseases—the malignant fevers preceding gradually, increasing in violence, and changing their form.

It has been the same in the United States. The first cases of the bilious plague have occurred early in summer, usually in July, sometimes in June. These have not excited much alarm, for they have not usually proved infectious; and they have, therefore, been classed among the ordinary diseases of the hot season. This, however, has ever been a mistake; they were the less malignant forms of approaching pestilence; yet five or six weeks after their appearance, when the epidemic has showed itself in its formidable array, our

citizens have hunted out ſome veſſel from ſouthern climates, and palmed the evil on her ſeamen or cargo.

Van Swieten, Comment. vol. xvi. p. 3, remarks, "that the plague has ſometimes lain concealed under the maſk of other diſeaſes. When the plague raged at Vienna, in 1713, it frequently aſſumed the appearance of a pleuriſy, catarrh, or quinſy; but ſoon after broke out buboes and carbuncles, moſt certain ſigns of the plague, accompanied with the uſual ſymptoms."

Here we obſerve the uſual precurſors and companions of the plague, and the progreſſion of the peſtilential principle.

Hippocrates has remarked the augmented violence of diſeaſes in particular periods. He ſays, "There are times when almoſt all the diſeaſes that occur are extremely malignant, and, in general, fatal; ſo that coughs, phthiſis, angina, are all equally mortal." He aſſures us, "that the truth of his obſervations had been confirmed in countries very different from each other, and in a variety of ſeaſons and climates."

See the paſſage cited in Zimmerman on Phyſic, p. 163.

We have multiplied proofs of the juſtneſs of theſe remarks. During the periods which I call *peſtilential*, the common diſeaſes of a country, as dyſentery and intermittents, become more obſtinate

ſtinate and mortal; and even the pleuriſy and peripneumony acquire unuſual violence. And it may not be improper to repeat an obſervation before made, that the malignant or epidemic pleuriſy never appears, except during theſe peſtilential periods. It precedes or follows, in winter, ſpring, or autumn, thoſe ſummers alone when peſtilence invades our cities. Such was the dreadful diſeaſe in America, in 1697—8, in 1761, and which has ſhowed itſelf, in ſeveral towns, during the preſent peſtilential conſtitution.

But a moſt ſatisfactory proof of the progreſſiveneſs in a peſtilential ſtate of air, and in the correſponding malignity of diſeaſes, is found in the Bills of Mortality. Thus, before the London plague in 1625, the Bill of Mortality roſe from 8 to 9000, the ſtandard of health; to 11,000 in 1623; and to 12,000 in 1624. The appearance of peſtilence was clearly announced two years before it appeared; and, as the time of its appearance drew near, the extenſion or malignity of the preceding fevers was greatly augmented; for in the year of the plague, almoſt nineteen thouſand perſons died of other diſeaſes than the plague. As the plague uſually prevails from June or July to November, and other diſeaſes are moſtly merged in it, almoſt all the deaths by common diſeaſes muſt have been in the beginning of the year, from January to June or July. Now, eighteen thou-

 ſand

sand deaths in the six months preceding the plague, or even two-thirds of the number, mark a prodigious increase of mortality, *the common sign of approaching pestilence.*

In the pestilential period in London, from 1634 to 1636, the Bills of Mortality rose two years previous to the plague.

The last great plague, in 1665, was announced by unusual malignity in diseases four years before its appearance. In 1661, according to Sydenham, began a series of epidemics, which greatly swelled the list of burials. There was, however, some abatement in 1663; but in 1664, and the first five months of 1665, the mortality again increased with rapidity, till a dreadful pestilence laid waste the city.

A similar increase of mortality is observable in the Bills of Mortality for Augsburg, previous to the plague in 1628, and in 1635—in Dresden, in 1632 and 3—in Philadelphia, in 1793—in New York, in 1795—and in New London, in 1798.

It must, however, be observed, that the Bills of Mortality will not, in all cases, exhibit the augmented number and malignity of the diseases which precede pestilence; for it sometimes happens that the year next preceding the plague is very healthy, and the malignancy in the distempers which mark the beginning of the pestilential state, do not appear till the winter or

spring

ſpring previous to the plague. In this caſe the augmented mortality falls within the year and the ſame bills, as the deaths by the plague. This was the caſe in Augſburg in the year 1535. In ſuch caſes there is an interval between the preceding epidemics and the plague; ſuch as we have obſerved in the New England States between the influenza and the ſcarlet fever, and the latter diſeaſe and the yellow fever.

Monthly bills will exhibit the progreſs of peſtilential epidemics with more accuracy.

Fernelius remarks, page 161, that "infection is to be perceived in the air when it produces fevers not peſtilential, but which are at the threſhold of peſtilence;" plainly intimating that certain malignant diſeaſes precede the plague. He ſpeaks of the fact as general and well underſtood.

Even in the Weſt Indies, the infectious yellow fever has its precurſors. That fever in Barbadoes, in 1738, was preceded by catarrh and ſuffocating cough, in 1737, and the ſpring of 1738. Yet authors pretend the diſeaſe to have been *imported* from Martinico!

See Warren and Short, vol. ii. 164.

The different modes in which peſtilence invades mankind ſeem to depend on different cauſes. Sometimes the principal cauſe ſeems to be an

eſſential

essential alteration in the invisible properties of the elements; in which case the diseases of a particular constitution, though somewhat modified in their symptoms, are not controlled or arrested by the seasons. On the contrary, the atmosphere continues to be pestilential, and to multiply disorders of a malignant type, through every variety of seasons and of weather. Thus we observe many instances of violent plagues in the most pleasant, and, to all appearance, the most salubrious seasons. Several instances have been mentioned in the preceding history, and we have demonstration of the fact in the United States. The present pestilential state commenced with the measles and catarrh of 1789—90. The summers of 1794 and of 1797 were apparently temperate and salubrious; yet, in both these summers, the plague renewed its ravages in some towns, though with less mortality than in the sultry and unhealthy summers of 1793, 95, and 98.

On the other hand, pestilence sometimes proceeds principally from excessively intemperate seasons, as in severe heat after a cold winter. In this case the pestilence may invade a city very suddenly, and without a regular augmentation of mortality from previous diseases; but, even in this case, the plague has its precursors, which appear at least a few weeks, if not two or three months, previous to its attack.

Thus

Thus the plague in Aleppo, in 1742, firſt ſhowed itſelf in the ſuburbs in April; but was preceded by an acute fever in March. The bilious plague in Philadelphia, in 1793, according to Dr. Ruſh, was preceded by the influenza, ſcarlatina, and bilious remittents. The ſame diſeaſe, in 1797, appeared, in ſcattering caſes, as early as June.

In New York the epidemic of 1795 was preceded by angina trachealis, with anomalous ſymptoms, ſome caſes of obſtinate dyſentery, at a premature ſtage of ſummer, and by febrile complaints, accompanied with bilious evacuations. At a meeting of the Medical Society, early in July, theſe facts were mentioned, as denoting an uncommon ſtate of air; and the Society came to a reſolution to make particular obſervations on the diſeaſes that might occur before their next meeting. But, in the interval, the criſis of the peſtilence arrived, and removed all doubts.

See Dr. Bailey on the Epidemic of 1795, p. 55 & ſeq.

The ſevere peſtilence of the year 1798, doubtleſs, owes its violence to a ſeries of moſt intemperate weather—moſt exceſſive heat, following a long and ſeverely cold winter. Yet this diſeaſe was preceded by premonitory ſigns, eſpecially catarrhous fevers. Of all the diſorders to which mankind are expoſed, none ſeem to indicate a peſtilential ſtate of air with ſo much certainty as catarrhous

catarrhous affections: they almost always precede the plague, usually accompany it, and sometimes tread close upon its heels.

In addition to the numerous authorities already cited, in proof of the progression of pestilence, let me mention Stenkius, who, in speaking of the diseases of 1564—5, observes, that anginas, pleurisies, and peripneumonies, became epidemic:—abortions were frequent, pains in the joints, small pox, and measles: "*Quos tanquam præcursores sequebatur epidemica lues, incredibili grassationis sævitia,*"—depopulating towns and country, in Turkey, Egypt, France, England, and Germany.

Observations, p. 748.

Stenkius remarked, that the plague followed the other epidemics, as *its precursors*.

The same author takes notice of a malignant angina in 1564, which often proved fatal in a few hours, like the plague. I mention this, because the learned Dr. Fothergill, and tribes of modern physicians who follow a celebrated name, have alleged that the *angina maligna* is a new disease, not known in Europe till about the year 1610, although it never was more fatal than in England in 1517.

In 1573 prevailed dysentery, measles, and purple fever; which, in 1574, says Stenkius, *changed into the plague*. His words are remarkable:—

 "*Dudum*

"*Dudum sane præsagiebat animus mihi, malignum hoc febrium genus, quod toto biennio Europæ partem non minimam peragravit, velut sparsis quibusdam præludiis, in pestem apertissimam transiturum. Neque me adeo mea fefellit opinio.*"—Observa. p. 761. This author foresaw the plague by means of its precursors.

"*Eodem modo variolæ, morbilli, dysenteria grassantes, sæpissime sunt præcursores internuncii pestis.*" Epidemic small-pox, measles, and dysentery, are very often the forerunners of the plague.

Horstius, p. 253.

It is a common remark, that the reigning epidemic subdues all other diseases, or compels them to wear its livery. This remark, as a general one, is just; and is of no small weight in proving the connection between certain species of epidemics. In the spring of 1795 the measles prevailed in New York, but of a mild type. In August this disease disappeared, being completely merged in the bilious fever that spread from August to November. No sooner had the fever subsided than the measles re-appeared, and was of a less favourable type. This is a contagious disease; and yet how impotent was the contagion, in the instance related, under the all-controlling influence of the season and the elements. It disappeared in summer,

mer, in defiance of the powers of ſpecific contagion, and was reproduced in autumn without its aſſiſtance.

This fact demonſtrates that a general cauſe operated in the production of that diſeaſe; which general cauſe, in ſummer, was controlled by the heat of the ſeaſon, and local cauſes in that city: theſe temporary and local cauſes operated during a particular time, and gave a different complexion to diſeaſes. When they gave way, at the approach of winter, the general cauſe again aſſumed its empire, and reproduced the meaſles, which is a diſeaſe little affected by local cauſes.

But while local cauſes predominated in producing bilious plague, the general cauſe was not altogether inefficient; no bilious peſtilence ever becoming epidemic and infectious, but under the influence of a peſtilential conſtitution.

A fact related in Fairfield's Diary relative to the ſmall-pox in Boſton, in 1702, is very much in point.

This diſeaſe appeared in June, and gave much alarm; but proved of a mild type, and none died of it for ſeveral weeks. It continued to be favourable till September, when it aſſumed a more formidable aſpect, being attended with what the writer calls a ſcarlet fever. The ſeaſon was exceſſively dry. In December the ſcarlet fever abated; but the ſmall-pox continued to be very mortal

mortal till the following ſpring. Theſe facts are related by an unlettered, obſerving man; but they are evidence of a progreſſiveneſs in the diſeaſe. The effloreſcence that accompanied the diſeaſe from September to December was only a particular malignant ſymptom, or modification, of the ſmall-pox, produced by ſeaſon, or other temporary cauſe.

The meaſles often exhibits a ſimilar progreſsion. This circumſtance explains the difficulties mentioned by medical writers. Dr. Ruſh mentions the circumſtance of perſons in 1789, who had a fever, cough, and all the ſymptoms of meaſles, except a general eruption. Some had a trifling efflorefcence about the neck and breaſt. The ſame happened in 1773 and 1783, vol. ii. 238. The fact is alſo mentioned in Edinburgh Medical Eſſays, vol. v. Perſons thus affected, have the meaſles months or years afterwards. This lighter ſpecies of the meaſles is produced by the ſame general cauſe which produces the diſeaſe in full force; but the conſtitution, at that time, reſiſts the further operation of the cauſe. At a future time, the cauſe will produce the diſeaſe complete.

Under the hiſtory of the diſeaſes of 1792—3, I have related the progreſs of the late ſcarlatina in this country. There cannot be a ſtronger evidence of the progreſſion of an epidemic influence in the atmoſphere than the hiſtory of that diſtemper

per has furnifhed. The violent ftage of that difeafe, was preceded four, five, and in fome places, eight months, by a milder fpecies of the diforder; and this mild form was, in fome places, an epidemic. Thefe facts entirely overwhelm all the pretended influence of infection in originating the difeafe. They prove, inconteftibly, that a ftate of air fuited to the production of that difeafe, was not the effect of any fudden, vifible change in the feafons; for the mild form of the fcarlatina appeared, indifferently, in every feafon of the year, as at New York in Auguft, at Hartford in May, and at New Haven in November; but that it was a progreffive change, gradually inducing debility in the human body, or whatever elfe may be its predifpofition to a particular difeafe.

Whether the fcarlatina appeared in any part of the country, without being announced by this flight form of the difeafe, is a queftion which cannot be folved, without particular information from every town. And, very poffibly, the fact itfelf may have paffed, in fome places, unobferved. But the progreffivenefs of the diftemper was diftinctly marked in New York, in Fairfield, in New Haven, in Bethlem, and in Hartford.

The fame phenomenon was obferved in the fame difeafe in 1786, in London. The firft cafe appeared in March, was of a mild kind, and excited no

no great apprehension. No other case occurred, to the knowledge of the physician, except in the same family, till May, when another case appeared; but of a light kind. In June the disease became epidemic and malignant. Here we observe the progress of the pestilential principle in England, like that which has been observed in America.

See Memoirs of the Medical Society, London, vol. i. p. 388.

A remarkable fact, mentioned by the great Mr. Boyle, in the fifth volume of his works, p. 724, serves to shew the regular progression of that state of air which produces the plague. In 1665, three months before the plague broke out in London, a man sent for a physician, complaining of a swelling in his groin, from which circumstance he predicted the plague which was to follow, and said he had experienced the same swelling in the former plagues, which he considered as the certain forerunner of the disease. Boyle took this account from the physician himself.

This is no whim, for it is perfectly philosophical. It is a common fact, that, during the plague in a city, persons in health experience severe pains in the glands, as in the groin and under the arms, those sensible parts which are peculiarly affected by the disease. Sorbait mentions, that he felt

 such

ſuch pains during the plague in Vienna, in 1679, and others did the ſame, but without any tumor. Dr. Gattwald experienced ſimilar pains in the plague at Dantzick in 1709.

See Baddam's Memoirs, vol. vi. p. 12.

Boyle, vol. vi. 429, relates, that one Beal knew a woman who could certainly tell when the plague was in the neighbouring country, by a pain in the wounds of three ſores ſhe had when affected by the plague in her youth. The relation is altogether credible; for we know that the ſtate of air producing the diſeaſe, occaſions pains in the glands of perſons in health; much more, therefore, would the ſame parts, after being rendered more ſenſible by plague ſores, be affected with pain during a ſimilar ſtate of air. The facts demonſtrate, that the plague is produced by a peculiar ſtate of air, which may be perceived before the diſeaſe appears; and much more, during its prevalence, by perſons in health.

Another fact, demonſtrative of the ſame doctrine of a progreſſion in the peſtilential principle, is, the unuſual number of abortions which *precede* the invaſion of a ſevere plague. This fact was obſerved by Diemerbroeck, previous to the plague in Nimeguen, in 1636; and is numbered by him among the preſages of the diſeaſe—*De peſte*, page 11. Other authors have recorded the ſame fact,

fact, among whom Diemerbroeck cites Alexander Benedictus, Forestus, and Sennertus.

The cause assigned for this phenomenon is, "the debility of the heart and other viscera, which renders the tender body of the fœtus incapable of resisting the malignity of the pestilential poison, and which exposes the woman, in a pregnant state, to continual irritation."

In confirmation of this principle, we may cite the facts so frequently mentioned by writers on this subject, that the plague rarely or never spares pregnant women. This was remarked by Livy and Dionysius in Rome—by Procopius and Evagrius, in the plagues of 543 and 590; and by subsequent writers.

The fact authorizes the supposition that a pestilential state of air induces extreme excitement or irritability, and, consequently, indirect debility, especially in the nervous and vascular systems. The effect of this general cause must, of course, be first visible in persons most susceptible of excitement, among whom are pregnant women, which is obvious from the facility with which they receive impressions from the sight of unnatural objects. The appearance of the effect of the pestilential state of the atmosphere on such persons, *previous to its fatal effects on other persons*, leaves no room to question its gradual increase of strength.

Of

Of the progreſſiveneſs of peſtilential epidemics, therefore, we can have no doubt, nor of their connection through a common cauſe. The order in which they ſhew themſelves is not always the ſame, being varied by a multitude of ſubordinate cauſes, as ſeaſons, weather, noxious exhalations, and ſometimes, perhaps, by infection.

The accounts of diſeaſes in the two or three laſt centuries are recorded with ſo little regard to juſt arrangement, that it is not eaſy to collect from them the exact order, in time, in which the epidemics of any particular period have appeared. Sydenham, however, has left an admirable ſample of the hiſtory of epidemics in London, from 1661 to 1680—a ſample that throws immenſe light on the principles here maintained—a ſample which ought to be well ſtudied, and which it is inexcuſable in medical writers not to imitate. Let any man obſerve the regularity with which certain eruptive diſeaſes, as the meaſles and ſmall-pox, appeared and ſubſided, according to the ſeaſons, during the conſtitution of air fitted to produce them, until both yielded to a different conſtitution, and then ſay, whether he can queſtion Sydenham's principles, or the exiſtence of a general contagion, operating in the production of a particular claſs of diſeaſes. Under a philoſophical view of ſuch facts, into what trifles will dwindle all the formidable vulgar doctrines about infection!

It

It muſt, however, be remarked, that the ſmall-pox, in modern times, will not exhibit ſimilar effects as formerly; ſince the art of inoculation has nearly baniſhed the diſeaſe, as an epidemic, from our cities, where alone it uſed to prevail to any conſiderable extent.

Let us then attend to the order of the epidemics which have marked the lateſt periods of peſtilence in America; moſt of which are within the memory of the preſent generation.

A. D.

1733 Influenza
1734 Unknown
1735, 1736 Angina maligna
1737 Severe influenza
1738, 1739 Peſtilence in Barbadoes, Charleſtown, and Mexico. Meaſles in New England.
1740 Meaſles in America
1741 Anginas, peſtilence in Philadelphia and Virginia
1742 Anginas
1743 Peſtilence in New York
1745 Dyſentery
1746 Fevers
1747 Fevers

1748 }
1749 |
1750 |
1751 } Fevers, dysentery, and angina. With the utmost diligence, I cannot learn whether measles or influenza prevailed during this period. The account, therefore, must be left imperfect
1752 |
1753 }

1754 }
1755 } Anginas

1756 Dysentery in some places
1757 Influenza
1758 Measles
1759 Measles, dysentery, fevers
1760 Unknown till autumn, then
1761 Influenza, and inflammatory fevers very fatal
1762 Pestilence in Philadelphia
1763 Pestilence among the Indians on Nantucket
1764 Unknown

1765 }
1766 } Dysentery

1767 }
1768 } Unknown

1769 Measles, angina
1770 Angina
1771 Catarrh, angina
1772 Influenza and measles, angina
1773 Angina, dysentery
1774 Angina, dysentery

1775 }
1776 } Angina and dysentery very fatal
1777 }

1778 Fevers, but no epidemic
1779 Health
1780 Health
1781 Influenza
1782 Ditto in Europe
1783 Meaſles, angina
1784
1785
1786 Anginas
1787
1788 Meaſles began in autumn
1789 Meaſles, influenza
1790 Meaſles, influenza
1791 Peſtilence began in New York
1792 Angina began in New York
1793 Angina, plague, and dyſentery
1794 Angina, plague, dyſentery
1795 Angina, plague, dyſentery, meaſles
1796 Angina, plague, dyſentery, meaſles
1797 Plague
1798 Plague, dyſentery.

Such has been the general courſe of epidemic diſeaſes in America, as far as I can obtain information. Further enquiries may render the account more accurate, and more nearly perfect.

It will be obſerved, that the order is not quite uniform; nor is this to be expected, conſidering the various cauſes which concur in the production and diverſification of diſeaſes. In general, meaſles

and catarrh precede anginas, dysentery, and pestilential fevers. And it is remarkable, that these diseases belong to the class of inflammatory diathesis: so does the mild small-pox, which, before the practice of inoculation, was almost regularly a precursor of the plague in the cities of Europe.

In general then, epidemic diseases first attack the brain and the throat, before they seize the whole nervous system, and the abdominal viscera. It is observable also, that winter, spring, and autumn, produce mostly diseases of the stenic diathesis, as measles, catarrh, and inflammatory fevers; and summer, diseases of astenic diathesis, as typhus fevers, dysentery of a malignant kind, and plague. Indeed, the plague seems to begin and end in catarrh—that is, it begins in catarrh in winter and spring, takes the form of plague, during the hot season, and re-assumes the catarrhal and inflammatory form in the succeeding winter.—The measles and influenza, however, prevail at any season.

When I arrange epidemics under particular years, I speak of these diseases which extend over a whole country, or occur in many places. If we look into large cities, we shall find some of these diseases almost every year. But my observations relate only to those diseases when they become general, or occur in various parts of a country in the same year.

When

When I place angina, plague, and dysentery, against a particular year, it is not intended that these diseases were all epidemic in the same place. Thus, while in 1793 the plague was in Philadelphia, the scarlatina was prevailing in New York and the western part of Connecticut. For it must not be overlooked, that although measles and influenza appear nearly at the same time in all parts of the United States, yet the pestilential fevers that follow them first shew themselves in the larger cities in the southern latitudes. Thus the measles and influenza were universal in 1789—90, at least this was the case with the influenza; but the bilious plague broke out in New York, Philadelphia, and Charlestown, before it did in Boston and Newburyport. The same is observable in the other hemisphere. The influenza spreads over Asia, Europe, and Africa, in a few weeks; but the following pestilence first appears in Egypt, or the Levant, or in Turkey, then in the northern parts of Europe. To these remarks, there are few exceptions.

It is also observable, that the pestilence in cities takes the form of petechial fever and plague; but, in country towns, more generally terminates in dysentery.

It is a popular opinion, that measles and small-pox never originate in the human constitution without contagion. The palpable absurdity of such

ſuch an opinion, has not prevented its propagation and belief, among even well informed men. So far is this opinion from truth, that the firſt caſes of theſe diſeaſes, in every epidemic period, are always generated in the human body without contagion. When the condition of the elements is fitted to produce theſe diſeaſes, they appear in all parts of a country without contagion, they ſpread rapidly, and decline when the general cauſes ceaſe to operate. During this period, contagion is efficacious in propagating them, and no longer. When the condition of the elements is not fitted to produce them, if ſporadic caſes appear in particular habits of body, they will not always ſpread the diſeaſe*. Sydenham, long ago, taught this truth, in deſcribing the changes in the epidemics of 1670, 1672. Meaſles and ſmall-pox came and went with the ſeaſons and condition of the air.

The truth is, that certain conditions of the elements tend to produce *eruptive diſeaſes*, and before the practice of inoculation, the ſmall-pox was almoſt regularly one of that ſeries of epidemics which I claſs together, as of one family, and

* This is here meant of the natural contagion of the diſeaſes from the breath and effluvia, which is not always efficacious in ſpreading them. The variolous matter of ſmall-pox is excepted, for, if good, this will communicate the diſeaſe at any time.

the

the precurſors of the plague. It is nearly allied to the meaſles, and appears uſually about the ſame time I am convinced, that catarrh, meaſles, mild ſmall-pox, and whooping-cough, are but varied forms of diſeaſe, occaſioned by modifications of the ſame elemental cauſes. Certain it is, they all predominate about the ſame time; and, as a general remark, they *precede* the invaſion of diſeaſes which bear the character of *typhus*.

I have never converſed with a phyſician who could not name inſtances of ſmall-pox originating without any known contagion; and, generally, medical gentlemen admit the diſeaſe to be generated in the conſtitution. This principle is unqueſtionably juſt, and ought to be known and received as truth; for the belief that contagion is neceſſary to the exiſtence of the diſeaſe, has produced moſt miſchievous conſequences. An inſtance happened in Sharon a few years ago, in which a woman was ſeized with the ſmall-pox, but as ſhe had not been expoſed to contagion, her diſeaſe was miſtaken till juſt before her death; and twenty or thirty perſons were ſuppoſed to have taken the diſeaſe before the true nature of it was underſtood.

In the winter of 1797—8 occurred in Hartford two ſporadic caſes of meaſles, which could not poſſibly be traced to contagion. At another time a family was infected by means of a ſtranger;

 but

but in neither of theſe caſes was the diſeaſe propagated to others, who were expoſed to the breath of the patients. See Dr. Cogwell's letter, Medical Repoſ. vol. ii. 301.—Innumerable ſimilar inſtances may be mentioned.

In the ſame manner, the various ſpecies of angina and the plague occur, in ſporadic caſes, under the operation of powerful local and conſtitutional cauſes, which, if not favoured by the condition of the elements, will not ſpread and become epidemic.

SECTION

SECTION XIV.

Of the Extent of a peſtilential State of Air.

FROM a view of the facts related in the preceding hiſtory, it appears that epidemics, agreeable to the definition already given, are of two kinds; firſt, thoſe which are limited to a particular town, city, or country; ſecondly, thoſe which pervade whole quarters of the earth, or the whole globe. The firſt may be called local, the laſt general, or univerſal epidemics.

The local epidemics moſt uſual are dyſentery, remitting and intermitting fevers, and peſtilence. The epidemic moſt frequently univerſal is the catarrh or influenza. Angina is often a general epidemic, ſometimes local. Peſtilential fevers, in certain periods, become general over vaſt tracts of the earth. The ſame is obſervable of the meaſles.

The epidemic catarrh is the diſorder which moſt deciſively proves a rapid and univerſal change in the eſſential properties of the atmoſphere. This diſeaſe ſometimes invades the human race ſo ſuddenly, that half the inhabitants of a town or city are ſeized in a night. I do not find the ſame fact related of any other diſeaſe, except the ſweating plague in 1529, whoſe progreſs through Europe

Europe was as rapid nearly as that of the catarrh, and utterly precludes the ſuppoſition that infection from fomes had any ſhare in its propagation.

Catarrh, however, is not always a univerſal epidemic. In many inſtances, it is confined to one hemiſphere, as in 1647, 1655, 1789, and 1790, to America, and in 1650, and 1775, to Europe.

In other inſtances, this diſeaſe ſpreads over the whole world in a ſhort period, but is progreſſive, appearing in the two hemiſpheres in two different years. Thus, in 1761, it was epidemic in America; in 1762 in Europe. In 1781 in America; in 1782 in Europe. In two inſtances I find it in both hemiſpheres in the ſame year.

The compilers of the Encyclopedia ſay, that catarrh from contagion has "ſeldom appeared in any one country in Europe, without appearing ſucceſſively in almoſt every different part of it; and in ſome inſtances it has been alſo transferred to America, and has been ſpread there, ſo far as we have had opportunities of being informed."

See Article, Medicine, No. 253.

No ſource of errors, in the ſcience of medicine, is more fruitful than the doctrine of contagion. It would ſeem, from the paſſage recited, that the writer conſidered catarrh as propagated by fomites from diſeaſed perſons, and conveyed acroſs the ocean by the ſick, or in goods,

or

or cloathing. The words will admit of no other interpretation; and yet it is hardly credible, that, in this period of ſcience and obſervation, an obvious and common phenomenon ſhould be ſo egregiouſly miſunderſtood.

The catarrh, whenever it has appeared as a general epidemic, inſtead of being *transferred* to America, has uſually appeared in America before it has in Europe, or at the ſame time; and ſo far is contagion from being the neceſſary cauſe of its origin and propagation, that the diſeaſe invades ſeamen on the ocean in the ſame hemiſphere, when three hundred leagues from land, at the ſame time that it invades people on ſhore. Of this I have certain evidence from the teſtimony of American captains of veſſels, who have been on their paſſage from the Continent to the Weſt India iſlands, during the prevalence of this diſeaſe.

If further evidence is required, we have the fact, that the epidemic catarrh in America rages with as much violence in the iſlands as on the Continent, and at the ſame time. And in the preceding hiſtory it is ſtated, on the authority of a medical publication in Scotland, that the univerſal catarrh of 1733 appeared in the iſle of Bourbon, in the Indian ocean, about the time it did in Europe.

From theſe facts it is evident that the diſeaſe is occaſioned by an alteration in the atmoſphere. In many inſtances it is limited to one hemiſphere; but

but it is obſervable, that whenever it appears on the American Continent, it appears alſo in the iſlands of the Weſt Indies. Its range is through a certain ſection of the globe, nearly in the ſame longitude, north and ſouth, on one of the great diviſions of the earth, and in the vicinity of the Continent. The epidemic catarrh of America extends certainly from the northern limits of the United States to the iſland of Barbadoes. Whether it appears at the ſame time in South America, I cannot find a hint in any author to guide my opinion, except in regard to the laſt epidemic which pervaded that part of the Continent.

The catarrh of 1733 extended over the globe; but it appeared firſt in America. Poſſibly there may have been other inſtances ſince the ſettlement of America; but I have little information on this point, in regard to this country. It is not probable, for inſtance, that the ſevere catarrh of 1708-9 was confined to Europe; but it is uſeleſs to indulge conjecture.

The remote cauſe uſually aſſigned for catarrh is a ſudden change of weather from heat to cold, or from cold to heat—the proximate cauſe, an increaſed afflux of fluids to the mucous membrane of the noſe, fauces and bronchiæ, with ſome degree of inflammation. Some medical writers ſeem to think the remote cauſe to be the application of cold only to the human body, checking the perſpiration by the ſkin, and turning

ing the fluids upon the mucous membrane. See Cullen on this point.

The proximate caufes of the difeafe are the province of medical men; but to the influence of the remote caufe above mentioned, phyficians will pardon me for ftating a few objections.

1. The application of cold to the body cannot be the fole caufe of catarrh, becaufe it appears, and ufually with moft feverity in the fpring, on the abftractions of cold. It is obfervable alfo, that in many inftances its principal violence and mortality is after the return of warm weather, the difeafe augmenting in violence with the increafe of heat. Thus the catarrh of 1709 appeared in Italy, fays Lancifius, in January, in fevere cold weather, but increafed in violence as the fpring advanced, and the weather moderated.

The fame fact took place in the catarrh of 1762 at Edinburgh, where it began in April, and increafed in violence till June.

In the fame manner the catarrh in this country in 1790, appearing in March or April, on the moderation of cold was far more fevere than that of the preceding autumn, when the weather was changing from heat to cold.

2. It is not always true, that the epidemic catarrh appears in fpring or autumn, or after great changes of weather. The noted catarrh of 1580 began to appear in Sicily in the month of

June; at Rome in July; at Venice and Conſtantinople in Auguſt, in the midſt of ſummer. It is againſt all probability, that this diſeaſe can be aſcribed to the application of cold. On the other hand, its progreſs was evidently ſteady, and uninterrupted by either heat or cold. A careful attention to the hiſtory of this epidemic at other times, will doubtleſs furniſh other ſimilar facts.

The catarrh of 1688 ſeized Germany in ſummer; that of 1557 appeared in Spain in Auguſt; that in America in 1655 began about the cloſe of June.

3. The appearance of catarrh in tropical climates, as in the Weſt Indies, at the ſame time it appears in northern latitudes, is a ſtrong argument againſt aſcribing it to the application of cold. In the Weſt Indies there is no change of any great conſequence in the temperature of the weather: nothing like cold is known in theſe regions. Yet catarrh, if credible accounts are to be admitted as evidence, is as fatal at times within the tropics as in any other climate.

It is true, that in autumn, winds called *Norths*, northerly breezes, are experienced in the iſlands, and theſe produce colds and coughs ſimilar to what we all experience in temperate latitudes on the change of weather, in ſpring and autumn. But theſe are very different, at leaſt in degree, from a general epidemic influenza, which ſeizes mankind in all climates with pain in the ſide

and

and bones, accompanied often with fever. The universality of this disease bursting suddenly upon all climates, and raging with equal violence in all seasons, and in defiance of heat and cold, leave us no room to question its dependence on some other cause than changes of weather, or application of cold.

4. If the application of cold was the sole cause of this epidemic, it would appear at the same time in all places which experience a sudden change from heat to cold at the same time. And further, a necessary consequence would be, it must be epidemic on every such change. Neither of these cases occurs. On the other hand, the disease begins indifferently in any climate, and in any season of the year, and spreads speedily over whole countries, without the least obstruction from heat or cold. And, as far as I can observe from accounts of it before me, it is as mortal when it invades people in hot climates, as in cold or temperate regions and seasons. It is also progressive in point of place; but it moves with a celerity unknown to all other diseases. Sometimes it passes over Europe in six weeks. In America its duration in 1789 and 1790 was nearly the same. Different epidemics, however, differ in the rapidity of their movements: that of 1580 was about six months in traversing Europe.

Different epidemics also differ in point of generality and violence. Sometimes the catarrh is

 a light

a light complaint, at other times it is attended with fever, and occaſions no inconſiderable mortality. The catarrh in the ſpring of 1790 was much more ſevere than that of the autumn preceding. In 1789 it reſembled a ſevere and univerſal cold; in 1790 it bordered more on the pleuriſy and peripenumony. To thoſe remarks there may have been particular exceptions.

5. It appears to me alſo, that, with deference to the faculty, a ſtrong argument againſt deriving the diſeaſe from ſudden changes of weather only, may be drawn from a difference in the ſymptom of an epidemic influenza, and of ſporadic caſes of the diſeaſe obviouſly contracted by cold. Let me aſk practitioners, whether, in the epidemic catarrh, there do not appear ſymptoms altogether unknown in ſporadic caſes? But as this is a point that regards practice, it is not proper for me to diſcuſs it.

The celebrated Boyle very juſtly obſerves, that ſudden epidemic colds are not to be accounted for by changes of weather, vol. 5, p. 49.

I do not, however, deny the influence of heat and cold in the epidemic catarrh. In ſome violent epidemics of this ſort, heat and cold ſeem to have little influence, the diſeaſe appearing to rage independent of all the ſenſible qualities of the air. Yet, in ordinary caſes, the temperature of the air ſeems to *modify*, but not to *degenerate*, or deſtroy the epidemic.

Brown,

Brown, in his Elements of Medicine, arranges catarrh among diseases of the stenic diathesis. Whether he meant to extend his observation to sporadic cases from cold only, or to the influenza also, I do not know. But it may not be improper in me to mention, that, in many epidemics of this sort, bleeding has proved injurious or fatal. The most generally successful remedies have been the diaphoretic, although there have been a few exceptions in which bleeding was salutary. Indeed no disease seems to admit of a greater diversity of symptoms.

Next to the catarrh, in the list of general epidemics, we may perhaps arrange the measles, which, though sometimes a local disease, often appears over whole countries, and sometimes in both hemispheres at the same time.

This disease is attended with specific contagion, which aids its communication from place to place; but it derives its origin from a particular state of the atmosphere. Hence it appears in one season, and disappears in another, yielding to some other disease, as Sydenham remarked in 1672, and which we observed in New York in 1795. It is nearly allied to the catarrh, as is evident from the catarrhous symptoms that attend it, and from the sameness in the mode of treatment. Brown classes the measles in the number of stenic diseases.

It will be found, on examining the history of diseases, that the measles usually precedes or follows an epidemic influenza. The two diseases, therefore, manifest a close alliance in the remote causes.

My accounts of epidemics are too imperfect to authorise the assertion, that these diseases *always* appear nearly together; but this has been the fact, with respect to a number of the last epidemics in America. The order, however, is varied. Sometimes also a slight degree of one or both of these diseases is experienced in particular places, when neither of them is epidemic. But when they become violent and general, they are nearly contemporaneous, spreading successively over a large portion of the earth, and sometimes over both hemispheres.

In 1772 the catarrh and measles raged in the same year, from Boston to Charlestown. To these succeeded anginas and dysentery for a series of years. In 1781 and 2, catarrh pervaded the globe. In 1783 began measles in May, and angina in August. In 1789 measles preceded the influenza. In 1757 influenza preceded the measles.

An epidemic which used formerly to make a figure in medical history, as one nearly contemporary with the measles, was the small-pox. The disease was observed by Sydenham to rage alternately with measles in different seasons of the year.

year. Like the meaſles, it is an eruptive diſeaſe of the ſtenic ſpecies, ſpecifically contagious, and evidently depending on the ſame general cauſe, though on different, temporary, or local, cauſes. Inoculation has nearly baniſhed this from the liſt of epidemics.

But a more formidable epidemic, and perhaps the moſt formidable to which the human race is expoſed, is *anginas;* uſing this word to denote all the different kinds of the affections of the throat. I call it the moſt formidable, becauſe hitherto no means have been diſcovered of arreſting its progreſs. Its horrors and fatality are not mitigated by the inoculation, like thoſe of the ſmall-pox; nor are its uſual ravages limited to populous towns, like thoſe of the plague, Under all aſpects, therefore, I conſider it as a far more dreadful diſeaſe than either, becauſe the others may be mitigated or avoided.

Affections of the throat, either in the form of ſcarlatina, anginoſa, angina maligna, cynanche trachealis, &c. are among the epidemics which belong to almoſt every peſtilential period. In the order of appearance, they have not one uniform place; but in America anginas have uſually ſucceeded catarrhs the firſt or ſecond year, and continue to the fourth or fifth. In the three laſt epidemic periods, this order has been very uniform. I ſpeak of epidemic angina, which

ſpreads over the whole country; for in particular places we hear of it almoſt every year.

Theſe diſeaſes, in our large cities, have been ſucceeded by the bilious plague, and in the country by violent remittents, typhus and dyſentery.

Sometimes angina prevails without being followed by the plague; that is, the conſtitution of air terminates at that point of its peſtilential progreſs. Such ſeems to have been the fact with the angina of 1755. And in all caſes in which it is of a mild kind, or not univerſal, ſtrong hopes may be entertained that no plague will follow it. The epidemic anginas from 1783 to 1786 were of this kind.

With reſpect to the univerſality of the cauſe of theſe epidemics, it is to be obſerved, that it is of two kinds; ſometimes it extends to both hemiſpheres, at other times it ſeems to be limited to one. Thoſe diſeaſes, however, which are leaſt influenced by heat or cold, or which depend moſt on ſome inviſible ſtate of the atmoſphere, appear moſt frequently in both hemiſpheres at the ſame time. This fact, with reſpect to the catarrh, has been particularly noticed.

The ſame fact is obſervable very often with reſpect to the meaſles, and eſpecially with regard to anginas. Theſe affections of the throat, when violent, are nearly contemporary in Europe and America. Witneſs the periods from 1751 to

1756,

1756, from 1773 to 1776, 1783 to 1786—from 1793 to 1796, and in 1742.

This contemporaneousness of certain epidemic diseases, in both hemispheres, is an important fact which has hitherto been little noticed, but which opens a new field for philosophical investigation. It demonstrates that such diseases are occasioned solely by a constitution of air, without the influence of contagion, although when the diseases are formed they are contagious.

But we have further facts of a similar nature. It is observable, that the pestilential principle often extends from Egypt, Syria, and Turkey, over all Europe, and to America. But the same diseases, that is, the same forms of the pestilence, do not always appear in Egypt, or Turkey, and in France, England, and America, in the same year. It is a general fact, that the worst form of pestilence, the inguinal plague, appears first in Cairo, Smyrna, or Constantinople; and from this circumstance the advocates for the propagation of that disease by specific contagion, have drawn their most powerful arguments in support of their theory. But this argument is founded on a view of the subject most miserably narrow and obscure.

In every pestilential period there is a series of epidemic diseases. The order in which they appear depend on local or temporary circumstances. Thus, in Grand Cairo, or Constantinople, the climate,

climate, or the ſtrong local cauſes, ſpeedily bring the peſtilential principle to its criſis, in the production of the plague. For this reaſon that diſeaſe appears in thoſe cities ſometime before it does in northern latitudes, or in more healthy cities.

But at the very time the plague appears in Conſtantinople or Cairo, ſome lighter epidemic diſeaſe, belonging to the ſeries, appears in other parts of the world, indicating the approach of peſtilence. Thus, in 1580 and 81, Cairo was deſolated by a hideous plague; but at the ſame time a ſevere epidemic catarrh burſt forth on all Europe, the certain forerunner of peſtilential fevers, and which, in that inſtance, was ſucceeded by plague in 1582 and 3, as far North as England.

Let facts within late periods decide this queſtion.

The plague appeared in the Turkiſh dominions in 1718; but in 1719 became more general. In 1718 the Bills of Mortality were conſiderably ſwelled in Amſterdam, London, and Vienna; but in 1719 they roſe in the two former cities conſiderably higher, the peſtilential ſtate of air pervading moſt of Europe. I have no account of the ſtate of diſeaſes at Marſeilles in 1718; but in 1719 appeared a peſtilential fever, which increaſed the mortality, although the peſtilential

principle did not rise to its height till the subsequent year.

In this period, contemporary with the plague in the Levant, was a universal increase of mortality in Europe; and the same state of air was experienced in America, although in very few parts of Europe did the pestilential principle arise to the degree of plague.

In 1726 we again hear of the plague in Egypt; and, for two or three years succeeding, the Bills of Mortality were swelled in Europe and America. Of the epidemics that prevailed in America, I regret my want of information. I only know that measles and malignant pleurisy prevailed in this country.

In 1735 and 6 raged the most desolating sore throat in America; and, at the same time, the most fatal plague in Egypt that has appeared in this century. This pestilence, like that in the time of Thucydides, took its rise in the interior parts of Egypt or Ethiopia. And it must not be overlooked, that the violence of the pestilence in Egypt corresponded with that of the sore throat in America, a fact which, as far as I can discover, is generally true, that the more fatal the epidemics that prevail over one quarter of the globe, the more violent are the same, or other pestilential diseases, in the other hemisphere. It makes little difference, that in one country rages

rages the glandular plague, and in another the petechial fever, or putrid ſore throat. Theſe are only different forms of peſtilence, *the effects of one common cauſe, modified by local cauſes.* The great point is, that ſuch epidemics are *contemporary in countries the moſt remote.* Slight epidemics may appear alone; but never the more ſevere and deadly forms of peſtilence, excepting, perhaps, dyſentery, or ſome other complaints that depend moſtly on the ſeaſons.

The years 1740, 41, and 42, were alſo peſtilential. At what time the plague of this period firſt appeared in the Eaſt, I am not informed, but it raged in Syria from 1742 to 1744; and it rarely happens that it is not a year or two earlier in Egypt or Conſtantinople than in Syria. Contemporary with the plague of this period, was great mortality in London and Amſterdam, from the petechial fever, which fell but little ſhort of the plague. See the Bills.

At the ſame time raged in America a ſeries of epidemics, particularly meaſles, anginas, and the bilious plague; the latter appearing in Philadelphia and Virginia in 1741, and in New York in 1743, the ſame year with the dreadful peſtilence in Meſſina.

The year 1755, the year of a great plague in Conſtantinople, was diſtinguiſhed for catarrh in Europe,

Europe, and ſore throat both in Europe and America.

In 1758 commenced the peſtilential period, which was univerſal, and felt in both hemiſpheres, in ſome one, or all, of the years from 1758 to 1763. Here, it is obſervable, our information is more correct. In 1758, contemporary with the beginning of this peſtilence, was an epidemic catarrh in Europe. Then followed other epidemics of a more malignant type. During this peſtilential period, appeared in America the catarrh, meaſles, and the plague in Philadelphia in 1762; but eſpecially the fatal epidemic pleuriſy in 1761.

The next period commenced in 1769 or 1770, in which the plague ſpread over the Eaſt. This period was begun by meaſles and anginas, if my information is correct, in 1769. Catarrh was epidemic in 1771 and 2; and in the latter year meaſles of a bad type. Then followed angina, and the epidemics all cloſed in dyſenteries. The plague in the Levant was contemporary with the commencement of this period.

I am not informed of the preciſe time when the plague of the next period commenced in the Levant, but it was raging in 1783 and 4, during the prevalence of meaſles and angina in America.

In the laſt period the plague in Egypt was very violent about the time the mortality commenced

menced in America. Of the precise time when it began in Egypt I am not informed; but it prevailed in 1791, the year it appeared in New York and Grenada, and was most destructive the following year, 1792, the year when the scarlatina appeared in the northern parts of America.

I have no farther accounts of the plague in Egypt; but the public prints have informed us the disease prevailed in Constantinople in 1797, and was more general in the Turkish dominions in 1798, the most fatal year in America.

The reader will be pleased to remark, that when I speak of the plague in Grand Cairo or Constantinople, I refer only to violent and destructive epidemics. The plague, in a light form, and in a few cases, occurs almost annually in those great cities where the common causes and ordinary seasons are adequate to its production in particular constitutions. But, let me observe, that no extensive or desolating plague ever ravages either of those cities, except under the influence of a general contagion, or an epidemic state of air, which is experienced nearly at the same time in Europe and America.

These facts enable us to solve the whole difficulty which has puzzled physicians, in regard to the different kinds of yellow fever which appear at different periods in the West Indies. The simple truth is, that, in ordinary seasons, when

no

no peſtilential conſtitutions of air exiſts, the fever of the Weſt Indies is not contagious.

But after catarrh has pervaded the hemiſphere, and during the increaſe of mortality in the Levant, in Europe, and on the American continent, that is, during a peſtilential ſtate of air; the fever of the Weſt Indies aſſumes double malignity, and becomes contagious. In years of health the diſeaſe never attacks natives of the iſlands; but in unhealthy periods, not only native whites, but even blacks, are ſometimes affected with the diſeaſe. Among theſe, however, it is leſs deſtructive.

Thus we ſolve the problem which has embarraſſed all the medical writers on the yellow fever, the moſt able of whom have been compelled to declare, that the fever in the iſlands is ſometimes contagious, and at other times not.

This view of the ſubject would have prevented the trouble of authors who have laboured to prove the diſeaſe imported from Siam, or the African coaſt. Dr. Chiſholm, inſtead of attempting to trace the Grenada fever of 1793 to Africa, through the ſhip Hankey, had only to remark the prevalence of the catarrh in 1790, of the plague in Egypt in 1791, and of the ſcarlatina in the United States in 1793, and he would have ſeen the beginning of a moſt extenſive and malignant ſeries of diſeaſes. The truth is, the peſti-

lential

lential ſtate of air firſt manifeſted itſelf in Grenada in 1791 (the year it commenced in New York) by new and ſingular ſymptoms, which ſurpriſed Dr. Chiſholm. And this, by the way, was before the beginning of the preſent war on the part of Great Britain; and, of courſe, it could not be aſcribed to that circumſtance. The ſame fact, when juſtly conſidered, is demonſtration that the diſeaſe was not brought from Africa.

It muſt be remarked, however, that the fever of the tropical climates, though not contagious in ſporadic caſes in healthful years, may at any time become epidemic and contagious under certain circumſtances. Thus large bodies of ſoldiers and ſeamen, paſſing ſuddenly from high northern latitudes into the Weſt Indies, may contract the diſeaſe, and render it ſo violent by crouded camps and ſhips, as to render it very infectious. This is uſually the caſe in wars between England and France, which call great numbers of men from Great Britain into the iſlands.

Yet, even in this caſe, the mortality of the diſeaſe is increaſed by a peſtilential ſtate of air, concurring with ſuch local cauſes. Such was the ſtate of air from 1760 to 1763, during which the Britiſh and American troops periſhed before the Havannah. Such alſo has been the ſtate of air for eight years paſt, in which the deſtruction of

of the British troops in the islands has been unparalleled.

This circumstance has led a respectable College of Physicians in Philadelphia to insinuate that war is a cause of the disease. Their words are, "It exists in the West Indies, particularly in time of war, when great numbers of strangers are to be found there, and reference to dates will show, that in *most* of the instances of the occurrence of the disease in the United States, there has been war in the West Indies." Memorial to the Legislature of Pensylvania. Dec. 5. 1797.

This assertion, however, is not authorized by facts. The deplorable plague in Philadelphia and Charlestown in 1699 was in time of peace. That in New York in 1702 was in the first year of a war, but could not have been derived from that circumstance in so short a time. The same disease at Barbadoes and Martinico in 1723, was in time of peace; in Charlestown, in 1728, in time of peace; at Carthagena, the next year, in time of peace; at Charlestown, in 1732, in time of peace; at Barbadoes, in 1738, in time of peace. The instances which happened between 1740 and 48 were in time of war, as was that in Philadelphia in 1762. The present war has exhibited melancholy effects of diseases in the West Indies; but it is an indubitable fact, that the plague of the present period commenced in 1791, a year

before the war, and before numerous reinforcements of troops had been ſent to the iſlands. It muſt further be obſerved, that during the eight years war between America and Great Britain, no yellow fever appeared in the United States! a ſtriking fact!

It is certainly a moſt unfortunate circumſtance for the credit of the College of Phyſicians, that the longeſt interval of peace during the preſent century, from the treaty of Utrecht in 1713, to the Spaniſh war of 1740, includes in it the longeſt and moſt ſevere ſtate of peſtilential diſeaſes in Europe, Africa, and the iſlands, that has occurred during the century. A ſimple inſpection of the Bills of Mortality during that period will demonſtrate the fact.

One thing however may be aſſerted with truth, that whatever may be the extent and violence of the bilious plague in the Weſt Indies, it never has appeared in the northern parts of the United States, except in periods when a peſtilential or ſickly ſtate of the air is manifeſted by the prevalence of other epidemics. In tropical climates, and in the ſouthern parts of America, particular circumſtances, as great bodies of freſh troops from northern latitudes, or unfavourable ſeaſons, may generate the diſeaſe in any year, however healthy, in temperate latitudes. But from Maryland northward, this American plague has never appeared without being preceded by other epidemics.

demics *. Let facts be resorted to for confirmation.

We read of malignant diseases in America anterior to the year 1699, but the order of them is not described. The fatal plague of that year was preceded by epidemic catarrh; and the plague raged at the same time in the Levant. The same disease in New York in 1702 belongs to the same period, which seems to have commenced in 1697, and ended in 1702.

The next sickly period was from 1709 to 1713, beginning in Europe with the severe catarrh of 1709, which was followed by plague in the Baltic-towns, in Hungary, Vienna, &c. accompanied by a most desolating sickness among horned cattle and horses in Germany and Italy. Of the effects of this constitution of air in America, I have but two instances, which were a most distressing sickness in Waterbury in Connecticut, which almost depopulated the town, and epidemic measles in 1712.

Of the most pestilential period about 1720, I have also but two instances in America: the mortality at Duck-Creek, as already related, and the malignant pleurisy at Hartford.

* The plague in Philadelphia in 1747 may be an exception, for I have no information what diseases preceded it. But I believe this will be found no exception.

The plague in Philadelphia and Virginia in 1741, and in New York in 1743, was preceded by the usual epidemics, influenza, measles, angina, &c.; and, at the same time, the plague was raging in the Levant, and in Sicily.

The same disease in Philadelphia in 1762 had its usual precursors, measles and catarrh; and this occurred during the prevalence of the plague in the Levant.

I hardly need to mention, in proof, the present epidemics. It is well known we have passed through the whole series of precursors, catarrh, scarlatina, measles, &c. the two former being far more general and severe than usual, indicated with infallible certainty the violence and extent of the plague which was to follow.

From a long series of facts, then, we demonstrate that the plague of our climate depends on some *general cause*. And it must abash and confound the sticklers for the propagation of this disease from country to country by fomes, to know that the disease never occurs in the temperate latitudes of America, except under a pestilential constitution of air, manifested by other malignant diseases in this country, which are certainly *not* imported; and during also the prevalence of similar diseases in the Levant, and an increase of mortality in other countries. It must still more confound these persons, if they have any susceptibility of conviction, to observe that

these very pestilential diseases, instead of being conveyed from place to place, appear at one and the same time in Egypt, Turkey, the West Indies, and in the United States. This is a very common, and probably is always the fact.

If the pestilence were introduced into this country from the islands; and if the disease is capable of being propagated as an epidemic from fomes, why, let me ask, has it never been propagated in the United States in healthy periods? It has been *imported* probably in hundreds of instances from the islands ever since the commencement of the West India trade.

Not a year passed from 1763 to 1791 in which multitudes of seamen or passengers were not brought into the United States, into large and small towns, and into hospitals filled with patients with the yellow fever upon them, and all their infected cloathing. Yet, in all this long period, no contagion appeared, although no precautions, at least in many parts of the country, were ever taken to prevent it. If the disease contains specific contagion, surely that contagion must take effect under all circumstances. Every man knows that the variolous matter of small-pox regards neither time nor place; its contagion acts in all years, seasons and climates.

This fact alone, that the bilious plague never shows itself in the temperate latitudes of America, except when the current epidemics of this country manifest a general constitution of air unfriendly to health, is sufficient to explain all the difficulties that have occurred to medical men and to others on the subject of the origin and peculiar symptoms of the disease.

Some of these remarks are in anticipation of the subject of another section, but they fall naturally enough under this head; the design of which is, to establish the doctrine of the universality of certain diseases at particular times, occasioned by a cause or causes extending often over a whole hemisphere, and sometimes over the earth. That such is the fact is demonstrated by the history of epidemics from the earliest ages to this day. A successive series of similar facts occurring age after age, leave no room for cavil or controversy.

I have confined my remarks on this head to the latest periods of the world, because the evidence is more complete. But a simple inspection of the preceding history will convince any candid person that the phenomena of pestilence have been uniform from the highest antiquity. In the most barbarous ages, when commerce was unknown, all the severe plagues appeared in almost every part of the earth in high northern latitudes, and among

among ſavage tribes which had no intercourſe with the Mediterranean. The cuſtom of deriving all plagues from Egypt, Syria, or Turkey, by ſpecific contagion, is *modern*; it is pointedly contradicted by all hiſtory—is unworthy of the enlightened period in which it has been advanced, and marks an extreme degeneration in philoſophy.

SECTION XV.

Of the Phenomena which attend pestilential Periods, with Conjectures concerning the Causes.

IT will not escape the most inattentive reader of the foregoing history, that all the violent and general plagues have been preceded or accompanied with remarkable phenomena in the physical world, as comets, earthquakes, explosions of volcanoes, and others of a subordinate kind.

We are to admit, with great caution, the influence of the planets in producing the calamitous diseases which, at periods, afflict mankind. It is an influence very uncertain and undefinable. It is not, indeed, unphilosophical to suppose the several immense orbs that compose the solar system to have an influence on each other by means of the great laws of attraction and repulsion. The contrary supposition would be most unphilosophical. But it might be very difficult to ascertain precisely what that influence is, because it might not be possible to separate its effects from those which are produced by other causes.

The ancients went much too far in ascribing events on this earth to planetary influence. They ascribed not only natural, but moral effects to that

that influence; and, by their extravagant ſyſtem of judicial aſtrology, brought into contempt the ſtudy of the influence of heavenly bodies.

We are not, however, to diſcard all conſiderations of ſuch an influence. We are naturally led to ſuppoſe that all parts of our ſyſtem are connected by principles of attraction; and that a certain order and equilibrium are neceſſary to keep all parts in due harmony. It is very obvious, that the moon has a moſt material influence in regulating the ſeaſons and changes of weather on this globe, eſpecially the weekly and monthly viciſſitudes. The more diſtant bodies may have ſimilar effects, though leſs obvious.

Comets, which approach and enter the ſolar ſyſtem at certain unequal periods, may alſo have ſome influence upon the ſeaſons. To aſcertain this point, I have collected all the information my reading has enabled me to diſcover.

The ancients believed thoſe bodies to be the cauſes, or at leaſt the harbingers of peſtilence, according to that line of Claudian,

"*In cœlo nunquam ſpectatum impune cometam.*"
"A comet in the heavens is never beheld with impunity."

But ſhould the fact be admitted, it might be ſtill a ſubject of enquiry by what means theſe erratic bodies injure the health of mankind. That they have ſome effect of this kind ſeems to be very

very probable, not only from the opinion of the ancients, who were careful in their obſervations, but from the very uniform coincidence of their appearance with extenſive peſtilence.

It is certain that comets have a very ſenſible effect on the weather. This was obſerved as long ago as the days of Ariſtotle, who remarks, Meteorol. lib. i. ca. 7. that comets denote great heat, tides and winds. He inſtances the ſwell of the ſea when Achaia was inundated, which was during the appearance of a comet. Pliny makes a ſimilar obſervation. "*Ventos autem ab iis graves æſtuſque ſignificari.*" Nat. Hiſt. lib. ii. ca. 25. Seneca was of the ſame opinion, and he mentions ſtorms of rain alſo among the effects of their approach.

Seneca, Nat. Queſt. lib. vii. ſect. 28.

It is true that great heat and drought, and violent tempeſts, mark the periods of the approach of comets; and it is equally true, that the winters of the ſame periods are remarkably cold. Ariſtotle himſelf mentions the cold of the winter during the appearance of the great comet, when Ariſteus was Archon of Athens.

The preceding relation of facts furniſhes a confirmation of theſe opinions. All the comets which have approached this earth in their paſſage to or from the ſun, eſpecially thoſe which have paſſed very near us, have been preceded, attended,

tended, and followed, by moſt extraordinary effects, as great heat and drought in ſummer, and ſevere cold in winter; deluging rains, violent tempeſts, and unuſual tides. Theſe we may conſider as the conſtant and certain attendants on comets. They occur ſo uniformly with the appearance of thoſe bodies, and for ſome months preceding and following, as to leave no room to queſtion the influence from which they proceed.

Through the medium of ſuch great changes in the ſeaſons, we may rationally ſuppoſe comets muſt affect the health of mankind. Extreme and unuſual heat ſeldom fails to produce a multitude of autumnal diſeaſes, as may be ſeen by the Bills of Mortality, and as the obſervation of every perſon can verify.

It is obvious, from the foregoing hiſtory, that one of the moſt certain effects of the approximation of a comet is a moſt ſevere winter. The almoſt uniform coincidence of theſe two phenomena leaves us no room to doubt their connection. Now it is a law of the ſeaſons, that the mean temperature of the air is nearly the ſame every year. This has been proved by ſeven years obſervations made at Salem by Dr. Holyoke, and publiſhed in the firſt part of the ſecond volume of the Memoirs of the American Academy. When, therefore, the cold of winter is long or ſevere in an unuſual degree, it muſt be counter-balanced in the ſucceeding ſeaſons by an extraordinary degree

of

of heat. This may happen to be effected by long mild weather in ſpring and autumn, but it is more uſual that ſevere winters are followed by exceſſive heat in the ſummer months. In this caſe the human body never fails to ſuffer. In ſuch ſummers bilious fevers and dyſenteries are commonly numerous and violent.

If therefore comets do in fact produce unuſually cold winters, which are neceſſarily preceded or followed by exceſſively hot ſummers, they may be conſidered as the remote cauſe of numerous diſeaſes.

But comets do, moſt evidently, occaſion at times exceſſive drought; and at other times extraordinary quantities of rain; and theſe intemperate ſeaſons not unfrequently ſucceed each other within a few months. No man can queſtion this fact who attends to the preceding hiſtory. All ſuch unuſual ſeaſons are apt to injure the vegetable kingdom. In too dry ſeaſons corn may be defective in quantity; in too wet weather it is deficient in nouriſhing qualities; and in both caſes it may contain the germs of epidemic diſeaſes.

That comets ſhould affect the health of mankind in any other way than through the means of the ſeaſons or weather, is poſſible; but is not to be admitted without moſt indiſputable evidence. It is indeed certain that the oriental nations believe, and have from high antiquity believed theſe bodies to be the forerunners of plagues;

plagues; and the enumeration of facts in the foregoing history evidently confirms their opinions. That history is probably defective in accounts of comets; but imperfect as it is, it affords proof that most of the plagues which have been extensive and severe, have been preceded or attended with the approach of comets.

From numerous facts in the history of pestilence, I am led to suspect that comets have some effect on the fire or electricity which surrounds and penetrates this globe. One of the most certain, as well as the most remarkable phenomena which attend plagues, is earthquakes; and, in general, the more severe or numerous have been the earthquakes, the more violent and destructive the plagues. This remark applies to most of the countries in Europe where the plague has been epidemic; but is more especially true of Italy and the Syrian coast, with the whole of Asia Minor.

In confirmation of this remark, we need not resort to facts in ancient times, when earthquakes seem to have been more frequent and violent than in modern times. Within the present century, the shocks which have uniformly attended pestilence, leave no room to question that some connection exists between the two phenomena.

Now, it is a fact that will appear from an inspection of the preceding history, that during the

the approximation of comets to our ſyſtem, earthquakes have been moſt numerous, general, and violent. A great proportion of the tremendous eruptions of volcanoes have happened during the ſame periods. To prove this, we need not go back to the terrible concuſſions and violent diſcharge of Etna, which cloſed the long peſtilence in Athens in the fifth and ſixth year of the Peloponneſian war; nor to the dreadful earthquakes and eruption which preceded the deſtructive plague in the reign of Titus. We have ſimilar facts in modern times. The plagues in the Levant in 1743, and eſpecially in Meſſina, were accompanied or preceded by violent earthquakes and a comet. The extenſive plague of 1760 was attended with all the great phenomena, comets, eruption of Veſuvius, and tremendous earthquakes. The peſtilential periods of 1770 and 1783 were introduced by the ſame phenomena.

Theſe facts afford ſtrong evidence that the approach of comets not only influences the weather, but alſo calls into action the ſubterranean fires. By what means theſe erratic bodies produce this effect may be a curious queſtion. That the internal fires explode at times without the attractive powers of comets is undoubted; but the concurrence of earthquakes, and violent diſcharges from volcanoes during the appearance of comets, or near the ſame time, ſeems to

render it certain that those bodies have a most powerful effect on the element of fire, which is diffused through the globe and the surrounding atmosphere.

Many authors have observed the connection between comets, earthquakes, and pestilence, but seem not to have included volcanic eruptions among the causes of disease.

"*In cœlo per quindecim dies apparens crinitum sidus siccatis plane terris attulerat,*" says Paulus Jovius: "*pestilentia quoque contagiis serpens, et in urbe et in castris.*"

Hist. Vol. ii. 111.

This observation of the writer is well founded. Comets seldom fail to occasion a universal defect of rain and springs in some countries, and pestilence marches in the train with its other effects.

"*Inter prognostica pestis est etiam cometes, jaculum et aliæ figuræ ardentes, diutius in suprema aëris regione subsistentes.*"

Horstius, from *Angelus Sola, de peste*, p. 253.

These remarks also are justified by our own observations. They were remarkably verified in the comet, the meteor, and the brilliant halo which marked the commencement of the last series of epidemics in 1788 and 1789.

Riverius is express to the same point. He asserts that comets never appear without being followed by epidemic and pestilential diseases, and

and various changes in the physical world. He instances that of 1618 in his own days. The observation is verified by the testimony of all ancient writers, and by a uniform series of modern facts.

The order of events is exemplified in the epidemic period of 1769 and 1782. In the first period excessive drought during the approach of the comet in 1769; failure of crops, famine and plague, and insects in 1770; volcanoes, earthquakes, and tempests in 1770 and 1771; catarrh and measles in 1772; then for several years anginas, putrid fevers, and dysenteries.

In the period of 1781 and 82, catarrh began the epidemics; in 1782 a universal failure of water, and of crops in India and Egypt; in 1783 a volcanic eruption, famine, measles, angina and plague; in 1784 a comet, followed by tempests, &c.

Earthquakes constitute part of the visible effects of the general cause which produces pestilence.

It has sometimes happened, that in these convulsions of the earth a vapour has been extricated which has produced immediate disease. The great earthquake in South America in 1730 was speedily followed by a pestilential fever. The destruction of Port Royal in Jamaica in 1692 was soon succeeded by a mortal fever in all parts of the island; and the universality of the fever

would

would lead us to suspect that vapour, in this instance, could not have been the cause. At Venice, in 1343, the plague soon followed an earthquake.

In the year 615 violent earthquakes in Italy were followed by "*lues elephantiæ.*" Baronius, vol. viii. 243. Baglivus relates that the great earthquakes in Italy in 1703 were succeeded by numerous diseases, especially opthalmia, erysipelas, mesentric fevers, and double tertians. In autumn the small pox became epidemic, apoplexies were frequent, and sudden deaths almost daily. With respect to apoplexies and sudden deaths after earthquakes, we have also the authority of Seneca.

Baglivus further remarks, "*post terræ motus frequentu succedunt pestilentiæ, vel morbi graves et epidemici, imo nova et inaudita morborum genera.*" p. 530. The idea that new and unknown species of diseases follow earthquakes, if well founded, leads us to suspect that the changes in the characters of diseases are attributable to the various action of the electrical fluid.

The terribly destructive earthquakes in Naples and Sicily in 1693, were speedily followed by malignant fevers, tertians, accompanied with delirium and lethargy; and the small-pox, which was very fatal to children.

Baddam's Mem. vol. iii. p. 91.

"Frequent earthquakes," says Fracastorius, *de contagione*, p. 136, "announce future pestilence;

and by means of exhalations tend to produce it." Van Swieten agrees in this opinion.

Seneca aſſerts, Nat. Queſt. Art. 27, that peſtilential diſeaſes uſually follow great earthquakes. He ſuppoſes the air incloſed in the earth to become vitiated, either by ſtagnation, or through the defect of the internal fires: "*internorum ignium vitio.*" He thinks this air, when forced into the atmoſphere, renders it impure, generating new kinds of diſeaſes. He reaſons by analogy, that as water corrupts by ſtagnation, ſo will air. Hence, after earthquakes, "*ſubita continuæque mortes et monſtroſa genera morborum, ut ex novis orta cauſis; nec prius peſtilentia deſinit, quam ſpiritum illum gravem exercuit laxitas cœli, ventorum jactatio.*"

This opinion of Seneca is certainly entitled to reſpect, and has been followed by many diſtinguiſhed authors, Van Helmont, Van Swieten, Sydenham, Hodges, Baglivus and others.

But I ſuſpect the modern diſcoveries will enable us to furniſh a more rational ſolution of the phenomenon. I am inclined to believe that a ſuperabundant ſtimulus occaſioned by the ſhock of an earthquake, and an atmoſphere ſurcharged with electricity, will more rationally account for the ſudden deaths, apoplexies, ſmall-pox and malignant fevers. If a deleterious vapour were the cauſe, I ſhould ſuppoſe its effects would be ſpeedy, and its

its force soon expended, the atmosphere being speedily purified by winds. But if stimulus is the cause, it may exist for a long time in the atmosphere, and the human body not yield to its force for many weeks or months. This would better accord with facts, for although diseases appear soon after an earthquake, yet the worst effects are often many months or a year after, as was the case in the reign of Titus, when the pestilence was the year after the earthquake and eruption of Vesuvius.

There are, however, many authorities in favour of the vapour. Seneca relates, that a vapour, caused by an earthquake in Campania, destroyed six hundred sheep. Van Helmont says, that "popular plagues do draw their first occasional matter from an earthquake."

P. 1125.

The fact that a visible vapour, without an earthquake, sometimes appears suddenly in a place, and evidently produces disease, is a strong confirmation of Seneca's opinion. A memorable example happened at Rouen in 1753, as related under that year. Forestus relates, that an epidemic catarrh or sore throat in Alkmaer, A. D. 1557, suddenly invaded 2000 persons, of whom 200 died. He ascribed it to a vapour, for the disease was preceded by thick clouds of an ill smell.

See Van Swieten, vol. xvi. p. 31.

 Mezeray

Mezeray relates, that the black pestilence of 1347 arose in China from a vapour, which burst from the earth with a smell most horribly offensive. This fact is cited by Boyle, vol. v. p. 60. in proof that pestilential diseases spring from vapours evolved from the earth. This author supposes new diseases may be generated by vapours; and remarks further, that countries abounding with cinnabar escape the plague.

But it seldom happens that pestilential diseases can be traced directly to earthquakes. On the other hand, although great plagues are almost invariably accompanied with shocks of the earth, yet it more usually happens that the pestilence appears before the concussion. Thus the shocks which alarmed and laid waste Italy in 1348, 1349, and 1350, were preceded by the dreadful plague of 1347.

Sometimes the earthquakes precede the plague, but more generally the pestilence appears first, or at least the petechial or other malignant fever, which marks the commencement of the pestilence. Thus the plague of 1760 was preceded by a spotted fever in 1759, which marked the approach of the calamity; which spotted fever appeared in Syria *before* the terrible earthquakes of that period.

In the well known plague at Oczakow in 1738 and 39, an earthquake happened about the time the disease began to abate. Van Swieten, vol xvi

xvi. 47.—Such was the fact in the days of Thucydides. Numerous observations on these phenomena lead me to suspect, that the fire which is to produce the explosion is in violent action for a considerable time *before* the shock, and that it is this *previous action* which occasions epidemic diseases. That is, the stimulus of fire or electricity produces sensible effects on the bodies of animals, the more susceptible objects, before it does on the less susceptible substances in the bowels of the earth.

The earthquakes do not always occur in the seat of the pestilence. I find no concussion mentioned to have happened at London in 1665, or in the years next preceding or following; but shocks were experienced in the neigbouring counties in 1665 and 1666.

This seems to have misled the able Diemerbroeck, who, in reasoning on the causes of the plague, objects to the influence of earthquakes, because no shocks occurred at Nimeguen before the pestilence of 1636. It is probably true, that earthquakes are not usually the *cause* of the plague; but that they have some connection with the cause, I can hardly doubt. The mistakes of Diemerbroeck and others on this point seem to have arisen from considering the plague as an isolated disease, and as depending on a cause local and temporary; whereas, a just view of the sub-

ject muſt comprehend all the diſeaſes of increaſed malignity which precede the plague, very often for two or three years. Such a view alſo muſt include, among the cauſes of the diſeaſe, the agitations or derangement of the elements in remote parts of the country. Thus, although no earthquake was experienced at Nimeguen about the time of the plague, yet a ſevere ſhock was felt at Lauſanne in 1634. Keyſler Travels, 190. This marked ſome general action of internal fire, which, though it might not explode ſo as to ſhake all Germany, might have produced effects, by means of an inſenſible vapour, or ſtimulus, in all parts of Europe. Certain it is, that for the period between 1631, the year of the tremendous eruption of Veſuvius, and the year 1637, all Europe was afflicted with mortal epidemics. The philoſopher who would obtain juſt views of the cauſes, muſt extend his enquiries to all the great phenomena which occurred during this whole period, in all Europe at leaſt, if not in the American hemiſphere: for ſuch a view only will comprehend the whole extent of the peſtilential ſtate of the atmoſphere.

It muſt not be forgotten, that during this period, from 1633 to 1637, when the plague, or other deſolating diſeaſes, ſpread over both hemiſpheres, Etna was in a continual ſtate of eruption; as it was for fifteen years, during the peſ-

tilential

tilential conſtitutions deſcribed by Sydenham in his days.

In looking over the liſt of comets, and the hiſtory of earthquakes, I am compelled to believe the approach of comets to have no ſmall influence on the ſubterranean fires. Such a vaſtly great proportion of the violent concuſſions of the earth have happened within a few months of the appearance of comets, that no reaſonable man can ſuppoſe the coincidences to be the reſult of accident.

Equally remarkable have been the coincidences in time between the appearance of comets and the exploſions of volcanoes. And this fact is no trifling confirmation of my opinion, reſpecting the influence of comets in producing earthquakes; for earthquakes and eruptions of volcanoes are often contemporaneous*.

I cannot

* It is not only during the *appearance* of comets that their effects are perceived in the elements, but for many months *before* and *after*. I can teſtify, from careful obſervations, that the effects of that in Auguſt 1797 were very obvious, in anomalous tides, as early as the laſt week in May; and the inundations in England during the autumn and winter following, ſhow its effects ſeveral months after its departure. The whole hiſtory of comets and their effects warrants this concluſion. Seneca made this remark ſeventeen centuries ago. Theſe are his words: "*Ariſtoteles ait, cometas ſignificare tempeſtatum et ventorum intemperantiam atque imbrium*"— "*Non ſtatim cometas ortus ventos et pluvias minatur* ſed totum annum ſuſpectum facit." Ariſtotle obſerves, that comets

indicate

I cannot however admit, that the explosions of subterranean fires are the direct existing cause of pestilential diseases. It is indeed ascertained, be-

indicate storms and violent winds and rain. These effects, however, do not immediately follow their appearance, but are to be expected during the whole year. He then mentions, that such was the fact with the comet predicted by Aristotle and Theophrastus, and which appeared in the Consulship of Paterculus and Vopiscus.—Nat. Quest. lib. vii.

I would further observe, that comets move in trajectories of an eliptical or parabolic form, the sun being placed in one of the foci. The time when we observe them is when they pass this part of the ellipsis. Now, according to the universal law of planets, by which they describe equal areas in equal times, their motion must be most rapid when nearest the sun and within our sight. Before their appearance, and after their departure, their movement is slower than when within the solar system, and they may be near the earth many months before they enter the system, or become visible. Hence their influence on the earth so long before and after their appearance.

It is further to be observed, that many comets doubtless enter the system and pass round the sun without ever being seen; and such as come from regions of space, directly opposite to the earth, must be *invisible*, unless we can see them in the splendour of the sun's rays. This remark is as old as Seneca, and older. He relates an instance, in which Posidonius discovered a comet in the darkness of a solar eclipse, which would not have been seen had not the eclipse happened.—Lib. vii. sec. 20.

Newton and Halley have made the same remark. Hence, perhaps, we may account for violent seasons, like the severe winter of 1780, which happened without the appearance of any comet. This is mere conjecture.

yond

yond all question, that periods of extensive pestilence and mortality are remarkable for earthquakes and eruptions of volcanoes. But the explosions of fire do not so generally *precede* epidemic diseases, as to authorize the supposition that they *produce* those diseases. Earthquakes occur during the prevalence of pestilential or other mortal epidemics, but in the midst of the period, or sometimes at the conclusion.

Hence I deduce an opinion, that pestilence and earthquakes depend on one common cause; which excites into action the internal fires. But I suppose the action or fermentation may precede, for months, and even years, the explosion in earthquakes and volcanoes; and by means of an insensible vapour or heat, or electrical discharges, the elements of water and air may be essentially affected in such a manner as to impair the principles of animal and vegetable life. Whether this is a just explication of the cause, may be a question; but so many phenomena concur to authorize it, that I cannot withhold my assent to the general principle.

The same effect perhaps may be produced by the excessive action of mere stimulus upon the animal system, without the infusion of deleterious vapour into the air.

A remarkable evidence of the effects of fire or electricity on the earth and air, before its explosion, is the extreme drought which is often experienced

rienced over whole continents, or the whole world, for ſix and even twelve months antecedent to a great eruption of volcanoes.

In confirmation of my principle, that the changes in the elements producing epidemic diſeaſes are effected by the all pervading action of fire, either culinary or electrical, the uſual appearance of meteors or celeſtial lights in peſtilential periods muſt be mentioned. For the truth of the fact we have ample proofs in every age. The inſtances of meteors, or other celeſtial appearances of fire, which are recorded of peſtilential periods, are ſo numerous as to leave no room to queſtion the connection between the cauſe of peſtilence, and the fire that belongs to the ſyſtem. Sometimes theſe fiery appearances are ſtationary lights in the ſky, which the frightened imaginations of men have formed into armies ready for combat, and conſidered as the preludes of bloody battles. Sometimes the heavens have been filled with thoſe ſmall meteors, called falling or ſhooting ſtars. At other times, immenſe globes of fire have traverſed the celeſtial regions and burſt with a tremendous report.

During a plague in Vienna in 1679, ſays Van Swieten, vol. xvi, p. 19, from Sorbait, ſeveral blueiſh fiery balls were ſeen in the air, ſome of which fell and ſenſibly increaſed the heat.

In October 1709, when the plague was in Dantzick, a blue fiery globe came from the north-

weſt

weſt and ſhot over the town with amazing celerity, illuminating the town and falling at the ſouthward.

Baddam's Mem. vol. vi. p. 14.

During the plague in Philadelphia in 1793, about the 12th of September, a meteor fell between the city and the hoſpital.

Ruſh. p. 108.

During the extreme heat which introduced the peſtilence of the laſt ſummer, 1798, about the 9th of Auguſt, the ſmall meteors or falling ſtars were incredibly numerous for ſeveral nights. They almoſt all ſhot from the north-eaſt to the ſouth-weſt, and ſucceeded each other ſo rapidly, as to keep the eye of a curious ſpectator almoſt conſtantly engaged.

Diemerbroeck remarks, that during the ſummers of 1635 and 36, at the time of the ſevere plague in Holland, there was a vaſt number of ardent ſtars gliding through the celeſtial regions and falling to the earth; "*Stellarum ardentium in cœlo aberrentium magnus concurſus et in terram prolapſio.*" He mentions, likewiſe, almoſt continual flaſhes of light, in a ſerene ſky, or ſilent lightning.

Livy mentions that the heavens appeared to be in a flame, previous to the ſevere peſtilence of the year 290 from the building of Rome.

A flame

A flame in the heavens is noted under the years 733, 742, and 788, all which were peſtilential. This flame is not deſcribed, and whether it was of the ſpecies of Aurora Borealis, which extended over the celeſtial region, or of that ſpecies of light or yellowiſh red colour, which diſtinguiſhes our modern *dark days*, cannot perhaps be determined. But a curious phenomenon of this kind happened in the ſevere winter of 1741, which was too remarkable to be paſſed over in ſilence; eſpecially as it may poſſibly explain what Livy and many other hiſtorians have recorded, that at certain times "it rained blood." The aſſertion is often found in hiſtorians of credit, and has, by the moderns, been numbered among the extravagancies of popular credulity. But an appearance which would warrant ſuch an aſſertion occurred in this country, and is ſtill recollected by old people.

In the month of January 1741, in the midſt of one of the coldeſt winters of this century, there was a little relaxation of the rigorous cold, during which the heavens were overcaſt with clouds, and a little rain fell. Late at night, during this falling weather, the heavens appeared all in a flame, ſo bright as to illuminate the earth, and render objects every where diſtinctly viſible. Many people ſaw it and were alarmed, ſuppoſing the great day was at hand. The rain which fell during this light had preciſely the appearance of drops of blood diſtilling from the clouds.

This

This relation was taken from my father, who was then nineteen years old, and recollects all the circumstances more minutely than the events of the last year.

The well known dark day in May 1780 was distinguished by a similar light in the heavens; but not occurring in the night, it was less an object of wonder.

I strongly suspect a similar phenomenon will account for those passages in many histories, which speak of raining blood, and enable us to do justice to the veracity of the writers.

Appearances of this kind have usually occurred in periods of pestilence, when the imaginations of men have been subject to alarm; and they have often happened during extraordinary seasons. The light of 1741 was during a most severe winter, and in the most sickly period that has occurred during this century. See the London Bills of Mortality. In America, that winter was followed by pestilential diseases.

The dark day of 1780 was on the opening of spring, after a most severe winter; and although that year was not sickly in general, yet, in the year following, we had an epidemic catarrh, succeeded by a series of epidemic diseases of other kinds. It is remarkable too, that on that very day began a violent eruption of Mount Etna.

In 1716, in the month of October, happened a dark day: this was after a most severe winter

in Euıope. I have no account of the ſeaſons in America; but the next winter was unuſually ſevere, and ſnow fell in extraordinary quantities.

On the 9th of Auguſt, 1732, happened another dark day. This was followed by earthquakes, a ſevere winter, and univerſal catarrh.

The 19th of October, 1762, was equally remarkable for darkneſs, with the phenomenon of a red or yellowiſh tinge in the heavens; which gave to the ſun, when it appeared, the colour of blood. Some rain fell during the day, and the water was of a dirty ſulphureous ſmell. There had been two earthquakes, with epidemic catarrh in America, in 1761. In the ſame year with the darkneſs, 1762, the catarrh was epidemic in Europe; and the winter of that year was exceſſively ſevere in both hemiſpheres. A comet appeared in 1762, and an eruption of Etna followed the ſevere winter in 1763. There were earthquakes alſo in Aſia in 1762. Who can doubt that the vapour occaſioning ſuch darkneſs is the effect of the agitation of the internal fire of the globe?

Similar inſtances of extraordinary darkneſs have occurred in every age. They are mentioned in the years before Chriſt 366 and 295, and of the Chriſtian æra 252, 746, 775, and in many other periods. And the reader will obſerve, this darkneſs is contemporary with peſtilence in almoſt every inſtance. During the plague of 746 the darkneſs was of ſeveral days duration: in 252 it was of three days, and

and in 775 of six days continuance. A similar darkness accompanied the pestilence in Egypt in the days of Pharaoh. Many other instances have been mentioned in the preceding history.

In America it has been customary to ascribe this unusual appearance to condensed volumes of smoke, after burning immense tracts of woods in the western parts of the country. But I cannot learn that any great fires have usually preceded these dark days; and negative evidence, in so many instances, amounts to proof that no great forests have been burnt. Besides, the same phenomenon has been often observed in countries where there were no forests, as in Italy, Syria, Asia Minor, and Egypt, and especially in England.

That the smoke of burning forests cannot be the cause may be rendered very certain by these considerations: First, the cause is not equal to the effect. Had the woods from the 40th degree of latitude in America to the 50th been all consumed in a day, the smoke would not have been sufficient to cloud the sun over the territory covered by darkness on the 19th of May. Any person may judge of this who has seen large tracts of forests on fire. That thirty or forty miles of burning forest should cover five hundred miles with impenetrable darkness, is too absurd to deserve a serious refutation.

In the second place, the colour of smoke, when elevated into high regions of the atmosphere, is very

very different from that of the vapour which causes the darkness on all such occasions. It forms a cloud, of a light woolly colour. Such was the cloud formed by the burning a square in New York, in 1797. The two objects bear no resemblance to each other; common smoke in the air being of a lighter colour, and not tinged with the yellowness of the vapour of dark days.

But what decides this question is the lightning, thunder and rain, and especially the meteors that accompany these clouds of vapour. As far as I can learn, some or all these phenomena attend dark days. Thunder was heard on the morning of the 19th of May, in most places.

Mem. Am. Acad. vol. i. 238.

Violent thunder, squalls and a meteor followed the great darkness in Canada, in 1785. These phenomena demonstrate that the clouds, on such occasions, have a connection with electricity. This is further evidenced by the smell of sulphur in the water that falls, and the scum that is left on objects. Smoke would not produce either; nor would the largest volume of smoke ever raised into the air, spread over an extensive region a dense substance that should become visible and tangible on the earth. Besides, this fog or darkness sometimes happens in winter, when the earth is covered with snow.

When

When we connect with these facts the circumstance that these dark days always occur during or near the time of volcanic eruptions, earthquakes, or the unusual seasons which accompany pestilence, and epidemic diseases of other kinds, we shall be at no loss to charge them to the account of the central fires, or the discharges of electricity. This accumulation of vapour is not a more surprising phenomenon than the sudden change in the properties of the atmosphere which produces universal catarrh. Hodges, who wrote on the plague of London, and who appears not to have been rewarded with celebrity equal to his merits, supposes the cause of pestilential diseases to be a subtle aura, or vapour exhaled from the bowels of the earth, which has, by too much heat and humidity, lost its wholesome qualities. He says, in proof of his opinion, that a given quantity of earth, infused into water in spring, deposits more salt than at another time of the year.

His idea seems to be not very different from that of Van Helmont, who supposes the cause of pestilence to be a gas, or air, which has *putrified by continuance*, as the translation is; by which is meant, probably, a stagnation in the earth.

The doctrine of an insensible vapour, infused into the atmosphere from the bowels of the earth, may perhaps be thought wholly conjectural. But there are some phenomena which can hardly be resolved without resorting to the action

 of

of electrical fluid. The ſudden changes of weather cannot be accounted for, in all caſes, by changes in the winds. Indeed the moſt reflecting philoſophical men acknowledge themſelves puzzled to aſſign reaſons for many of the rapid tranſitions from heat to cold and from cold to heat. It has been ſuggeſted, that the heat may aſcend and deſcend in the atmoſphere, by means of phyſical laws, to us unknown; but this ſuppoſition is not ſupported by any clear proofs, perhaps not by rational probabilities.

There are many reaſons which incline me to believe that the principle of fire, the moſt ſubtle, penetrating, active fluid in creation, and unqueſtionably the moſt powerful agent in all the movements of matter, paſſes more frequently and rapidly from the earth into the atmoſphere, and *vice verſa*, than is commonly imagined. I ſuſpect that an intimate connection ſubſiſts, in this reſpect, between the interior of the globe and the atmoſphere which ſurrounds it.

To the rapid paſſing of heat from the earth to the air, and from the air to the earth, we may perhaps aſcribe many of the amazing changes which take place in the temperature of the air, in a few hours, and often without a change of wind. The increaſe and moderation of cold are ſometimes very obvious, long before the change of winds to which we uſually aſcribe ſuch changes; and I ſuſpect that the changes of winds are more fre-

frequently the *effect*, than a cauſe of a change in the temperature.

But there are ſome appearances in the atmoſphere, previous to the ſhocks of earthquakes, which demonſtrate a cloſe connection between the atmoſphere and ſubterranean fire. A remarkable one in this country, and generally in others, is a univerſal ſerenity and tranquillity in the atmoſphere. The ſky is cloudleſs; and all nature, if at night, is wrapped in profound ſilence. This phenomenon is too uniform a precurſor of earthquakes to be deemed an accidental circumſtance. It muſt be an effect of ſome connection between the air above and the cauſe of earthquakes.

It is remarkable alſo that ſeamen ſometimes obſerve a ſwelling of the ocean, without wind, and before any ſhock of the earth; and this fact Pliny mentions among the ſigns of an approaching earthquake *. The ſame author mentions a well-known

* Is not this ſwelling of the ocean, previous to an earthquake, analogous to the tides? May not both be aſcribed to the force of electricity? the ſwell of the water preceding earthquakes being irregular, as depending on no regular viſible cauſe; and the tides being more regular, as being the effects of the moon's influence on the electrical principle. This idea ſeems to derive ſome ſtrength from the known fact, that earthquakes uſually happen in periods of the moon's revolution, when that orb exerts its greateſt influence on the earth. From numerous calculations it appears that earthquakes uſually occur near the moon's perigee or apogee, or the change or conjunction of ſun and moon; generally about

known fact that, some time before the concussion, birds appear to be greatly agitated, and retire. In Italy, a common prelude of an earthquake is, a thin, white, oblong cloud or vapour, nearly resembling the colour of wool. This sign was seen, for several days, in the year 1702, before the earthquake. The same was observed by Cassini, in 1668, in the same part of the heavens, the sign of the whale.

See Pliny, lib. 2. 81. Baglivus, page 543.

The evening before a violent earthquake in Sicily, in 1693, bright flame was observed, ap-

about three days before or after the conjunction.—This, by the way, is the very time when epidemic diseases usually invade the patient, or come to fatal termination, according to the remarks of all modern physicians—a singular fact that may lead to important conclusions.

In a few instances, earthquakes happen near the full moon—the other position in which that satellite exerts more than her ordinary influence on the earth.

Let these facts be compared with the occurrence of violent tempests about the same time of the moon's revolution, the invasion of epidemic diseases, and the full tides.

A strong confirmation of this opinion is derived from the swelling of the sea, just before a hurricane in the West Indies. There is a visible intumescence before the atmosphere is clouded, or the least breeze of wind. What can be the cause, but the electrical fluid which is passing from the earth to the atmosphere, and is speedily to produce most tremendous effects.

See the Addenda

parently

parently about a mile diſtant from the ſpectator: this flame vaniſhed as ſoon as the ſhocks occurred *. The day ſucceeding the firſt ſhock, the ſky was darkened, and tinged with a deep yellow. This was the preſage of a moſt tremendous concuſſion, which demoliſhed many towns in Naples, Sicily and Malta.

Seneca relates that a violent earthquake in Campania, although in winter, was preceded by a calm of ſeveral days duration.

Nat. Queſt. lib. vi. 12.

For ſome time before the great earthquake in Italy, in 1638, the air was perfectly calm, and the heavens ſerene; but the ſea was covered with little bubbles, as if agitated by drops of rain.

The phenomena that occurred in Germany and Holland, on the day, but *not at the hour* of the tremendous earthquake which demoliſhed Liſbon in 1755, were very remarkable. The water was violently agitated, buoys were broken from their chains, large veſſels ſnapped their cables, ſmaller ones were thrown on ſhore, boats in canals were forced from their faſtenings, chandeliers vibrated in the churches, water in ſmall veſſels was agitated and daſhed over the ſides; and all this without any ſenſible motion of the earth or buildings.

See Encyclopedia. Art. Earthquake.

* A ſimilar light was ſeen at Derby, in Connecticut, in the evening preceding a local exploſion of fire, about thirty years ago.

 These

These phenomena indicate a connection between the atmosphere and the subterranean fire, which is altogether invisible, and, to men, imperceptible. We perceive nothing before the shock but universal serenity and calm; but the delicate senses of the fowls of heaven are affected: they fly about in a fright, and appear to want the usual support from the air. The waters of the ocean also swell, although no concussion of the earth or water can be perceived. Do not these phenomena indicate either a want of the usual weight or elasticity of the air? Or what defect is there in the mass of air surrounding the earth, which is to be supplied by an explosion of subterranean fire? That there is a connnection or dependence of the fire above on that beneath the earth, and that this subtle fluid acts and re-acts between the earth and the air, with a rapidity and a force beyond all calculation, is to me extremely probable. The appearances that precede earthquakes indicate that the fire which is to produce the shock, is in violent action for a considerable time before the shock. For several days before the earthquake at Oxford, September 17, 1683, *ignes fatui*, luminous appearances, were frequently seen.

Baddam's Memoirs, vol. ii. 208.

It sometimes happens that hot springs burst forth before earthquakes; and miners perceive heat in the earth.

Often

Often have earthquakes been preceded by a perturbation, a ſtench, or diſcolouration of the water in wells and ſprings.

Sometimes the water in wells and rivers recedes or is evaporated before the exploſion. It is ſaid that Pherecides once predicted an earthquake in Lacedemon, from the diſappearance of the water in a well.

Pliny. Nat. Hiſt. lib. ii. 79.

The rivers and ſmall ſtreams in Iceland are obſerved to become entirely dry for ſome weeks before an eruption of Heckla, as was the caſe in 1783. Meteors alſo, earthquakes, and ſometimes flaſhes of lightning, precede or accompany the eruptions.

See Van Troil's letters on Iceland.

The various ſounds or noiſes which precede and attend earthquakes, are a ſtrong confirmation of thoſe ideas. The uſual premonitory ſound is compared to the rattling of carriages on a pavement. Sometimes it is deſcribed as the rumbling of diſtant thunder. But, in truth, the ſound is different at different diſtances, and reſembles no other ſound in nature. It is altogether *ſui generis*. It is moſt analogous, when near, to the rattling ſound from a near exploſion of the electrical fluid: as thoſe can teſtify who have been near the place where lightning has fallen upon objects. It bears no reſemblance at all to any artificial ſounds

made by the explosion of gunpowder, or other human contrivances. It is most unquestionably the effect of the electrical fluid rushing from one part of our system into another—probably from the earth to the atmosphere, to restore the equilibrium, which has been, by some means, destroyed, or to answer other unknown purposes. This idea corresponds with the modern theory of earthquakes, which ascribes them to the electrical fluid.

See the Encyclopedia, Art. Earthquake *.

Eruptions of volcanoes have also been preceded many weeks by a visible fog or vapour, suspended over the mountain, as happened before the great discharges of Heckla, in 1783. To what cause shall we ascribe this, but to the action of fire which precedes the explosion? And if a visible vapour may be extricated by this action, *for months* before the explosion, of which we have *certain* evidence, why may we not suppose a smaller action or force to expel invisible vapour, in any place, and at any time?

Other facts authorise this conjecture. On the 12th of September, 1784, the water of the loch Tay, in Scotland, suddenly receded 300 feet, and left the channel dry; then returned; continuing this vibration for every seven minutes, for two hours, and at the same time of the day, for a

* At sea, no noise is heard before an earthquake; water being a good conductor of electricity.

week, with lefs violence. No wind was ftirring, and no vifible caufe could be affigned for this novel phenomenon. To what caufe fhall we refort for a folution, but to the invifible energy of electrical fire. Sinclair. vol. vi. 623.

If we admit, then, the action of electricity to be the caufe of earthquakes, we fhall have reached the general proximate caufe of thofe epidemic difeafes which fpeedily fucceed concuffions of the earth. The caufe muft be the action of fire, the moft energetic principle in nature. The manner in which this effect is produced, whether by forcing an unwholefome vapour from the interior of the earth, and vitiating the atmofphere; or whether by fimply changing, on mechanical principles, the proportion of oxygen contained in atmofpheric air, or by mere ftimulus, or other unknown means, is a queftion of a curious nature, and worthy of a philofophic inveftigation.

One thing is very evident, that what I denominate a *peftilential principle*, does, at certain times, pervade not only the element of air, but the water alfo. The proofs of this are abundantly numerous and convincing. In all the great plagues which have afflicted the human race, other animals, as horfes, cattle, fheep, fometimes cats, dogs, and fowls, together with the fifh in rivers and the ocean, and even vegetables, have borne their fhare in the calamity. The peftilential principle has extended to every fpecies of life.

The

The beaſts of the field periſh with deadly epidemics; the fiſh die on the bottom of rivers and the ſea, or become lean and ſickly; while corn is blaſted on the moſt fertile plains, and the fruits in gardens and orchards wither, or fail to arrive at their uſual ſtate of perfection.

In the deſtructive plague which deſolated Italy in the time of Romulus, Plutarch and Zonaras mention a general ſterility of the earth; the very trees were affected, and all nature appeared to be defective in its powers of production.

In the beginning of the peſtilential period, in the reign of Juſtinian, Baronius ſtates that corn was deficient in quantity and defective in its nouriſhing qualities.

About the year 1600 crops failed in all parts of Europe; as they did in both hemiſpheres, about the cloſe of the laſt century. Such was the caſe in 1740 in ſome parts of Europe; and in 1766. The failure of grain in India, in 1770, and in 1783 and 1789, are ſtill remembered; and in ſome of theſe inſtances, the crops failed, at the ſame time, in China, India, Europe, and America.

When exceſſive rains or dry ſeaſons precede this failure of crops, men are at no loſs to aſſign the cauſe; although, in theſe caſes, they may ſometimes miſtake the true cauſe. But it often happens that grain fails of its uſual perfection, in ſeaſons apparently the moſt temperate and favourable. Obſerving farmers remark, that, in certain

certain years, when blaſt or mildew is expected from intemperate weather, grain proves to be good ; at other times, grain will ſhrink very much, under a ſeries of weather apparently the moſt propitious. This has been obſerved in Fairfield County, in Connecticut, where the excellent lands formerly produced great crops of wheat, with as much certainty as any other grain ; but, within a few years paſt, wheat has failed, without any apparent cauſe. In ſome caſes the farmer ſcarcely receives his ſeed, although the ſeaſons are favourable, and no inſect appears.

The failure of certain ſpecies of fruit trees and ſhrubs is a fact equally remarkable.

Some kinds of apple, and particularly the pippin, for a few years paſt, have been ſmall, knotty, and ſprinkled over with ſpecks.

The plum-tree has become full of warts, or bulbous excreſcences, which kill the tree, and, in ſome parts of our country, bid fair to extinguiſh the ſpecies. Theſe are found to be occaſioned by a fly or inſect, which perforates the bark ; but it may be conſidered as a diſeaſe occurring at certain periods ; and, in the preſent inſtance, has been contemporary with the peſtilence in America. The inſect itſelf is an effect of the general deleterious cauſe.

The peach tree has, within a few years, been particularly ſubject to be deſtroyed by a worm, which attacks it juſt below the ſurface of the earth,

earth, and ſeparates the bark from the wood. If this is a common evil, ſtill the vaſt increaſe of it, at particular periods, is among the phenomena of peſtilence. The locuſt is periſhing by a ſimilar malady.

Contemporary with theſe diſeaſes of the plum and the peach, has been a diſtemper of the pear, uſually called the pound pear, one of the moſt delicious of the ſpecies. For eight or ten years paſt, that fruit has been univerſally, in the part of the country to which my obſervations have extended, ſubject to a blaſt, from a ſpecies of ruſt which covers a large portion of its ſurface. In my own garden, not one in five is fit to eat; but I have ſeen one gentleman in a neighbouring town who thinks the pear is beginning to recover.

The univerſal death of the prim is a phenomenon ſtill more extraordinary, and a moſt ſevere calamity. The town of Eaſt-Hampton, on Long Iſland, loſt, in two or three years, two hundred miles of hedge—a greater loſs, ſays M. L'Hommidieu, in a paper publiſhed among the tranſactions of the New York Agricultural Society, than if every houſe in the town had been burnt to the ground: as no proper ſubſtitute for fences has yet been diſcovered. The Engliſh black thorn has been tried, but has failed, owing to a fly that perforates the bark.

See Part ii. 103,

The cauſe of the death of the prim is not known, nor the preciſe time when it began. But in Connecticut the failure was obſerved, about twenty-five years ago, between the years 1770 and 1777, during the prevalence of the terrible angina and dyſentery among men. It continued gradually to extend for ſome years, and the prim has at laſt totally diſappeared.

It is remarkable that theſe diſeaſes among corn, fruit-trees, and ſhrubs, have generally, if not always, appeared firſt on the Atlantic ſhore, and gradually extended themſelves into the interior country. This is an obſervation made by many men in different parts of Connecticut. May we not, from this circumſtance, deduce an argument that the *infection is imported?*

But theſe phenomena are not *new* in the world; they are new only to people who do not read. Avicenna, the Arabian phyſician, an author of great celebrity, ſays, that the "ſtate of air called corrupt either impedes the growth of plants, or covers them with ruſt." Diemerbroeck, de peſte, p. 40, 41, enumerates, among the effects of a peſtilential air, the corruption of grain and fruits, the production of mice and noxious inſects which corrode and devour the corn; the ſterility of the earth, which fails to yield the uſual quantity of grain and fruits." He takes notice alſo of another fact, which is, the unuſual diſpoſition to putrefaction in all kinds of fiſh, fleſh, and vegetables, during

during peſtilence. This putrefaction is by the moderns conſidered as a fruitful ſource of diſeaſes. In ſome caſes it may be ſo; but it is always an *effect* of the ſame cauſe which produces epidemics.

Another remarkable fact to prove the univerſality of the peſtilential principle is the ſickneſs and death of fiſh in rivers and the ſea. Several examples are recorded in ancient hiſtory. See the years 590, 994, 1240, and others. The number, however, of ſuch facts is not great in the old books; and whenever this phenomenon occurred, it was aſcribed to froſt, to a battle among the fiſh, or other improbable cauſe.

In modern times we have many examples recorded; but, probably, many others have eſcaped obſervation, or been conſidered as things of no moment to mankind; for, within a century paſt, the opinion that the plague is propagated in northern climates by contagion only, ſeems to have ſuſpended all rational enquiries into the cauſe of the diſorder.

That the fiſh on the Britiſh coaſt, or in the rivers, periſhed during the laſt great plague in 1665, I find no where related in a manner to render the fact certain; but I find Hodges has mentioned a fact of that ſort, as a proof that peſtilence is occaſioned by an unwholeſome vapour from the earth.

The

The death of the haddock on the coaſt of Norway, in 1789, has been already mentioned; but as there were many ſhocks of earthquakes in Scotland about that period, it is not impoſſible that the haddock might have been ſuddenly killed by ſome concuſſion of the water. A ſimilar event took place on the American coaſt, in the great earthquake of November, 1755, when ſome whales and multitudes of cod were killed, and ſeen afterwards floating on the water. I throw all ſuch caſes out of the queſtion, and confine myſelf to the ſickneſs and death of fiſh, when there has been no concuſſion of the waters to occaſion a violent death.

The diſappearance of blue fiſh from Nantucket, in 1764, juſt after the great mortality among the Indians, is a remarkable fact. Not leſs ſingular was the ſickneſs and extinction of the Wellfleet oyſters, in 1775, the year of a fatal dyſentery in America. Still more remarkable was the ſickneſs or ill ſtate of the cod fiſh taken on the banks of Newfoundland, in the year 1788. They were thin, unfit for uſe, and, when preſerved, turned to a blue or dark colour.

Ariſtotle remarked, that no peſtilential diſeaſe appears to affect all kinds of fiſh; but that theſe animals are ſubject to ſickneſs, which is known by their being thin, and not changing their colours.

De Hiſt. Animal, lib. 8, ca. 20.

But

But to come ſtill nearer to the preſent time. In the years 1793—4, the oyſters on the coaſt of Connecticut and Rhode Iſland were all ſickly, watery, and taſteleſs, and wholly unfit for food; and, in ſome inſtances, brought on nauſea or ſickneſs in thoſe who ate them. This was the very time when the ſcarlatina was ſpreading over the country, with malignant dyſentery and typhus.

The ſhad which came to New York market in the ſpring of 1796, which was the period of peſtilence in New York, were leaner than uſual, and periſhed, in defiance of the powers of ſalt.

In 1797 multitudes of ſmall dead fiſh floated down James River in Virginia. It is remarkable that, in the ſummer following, all the country from Norfolk to Philadelphia, the very latitudes through which that river paſſes, was very ſickly: Norfolk, Baltimore, Philadelphia, were all afflicted with the bilious plague.

I have been informed, that many dead ſhad were ſeen to float down the Suſquehanna in June, 1798; but of the fact I have not ſatisfactory evidence.

The reader cannot fail to remark here the correſpondence in place between the epidemic diſeaſes in the water and the air; the fiſh and the human race, in contiguous regions, being diſeaſed about the ſame time: a fact too remarkable to be permitted to eſcape particular obſervation.

The

The mortal peſtilence among cats, in Europe and America, in 1797, is a fact too well known to be repeated. The ſickly ſtate of the water in the wells of New Haven, during the peſtilential period of 1795, was evidenced by the number of animalculæ it contained.

Paracelſus mentions the death of fiſh, but aſcribes it to the influence of the planets.

Vol. i. 167.

Sorbait relates that, in the time of the plague at Vienna, I ſuppoſe in 1679, a fountain in the ſuburbs, which had been eſteemed for the ſalubrity of its waters, exhaled a ſtench which appeared to increaſe the mortality in the vicinity.—Van Swieten, vol. xvi. 47.—It is probable that Sorbait has miſtaken the effect of this ſtench: it is probable that the great mortality in the vicinity, and the impurity of the water, proceeded both from one ſource, an uncommon effuſion of ſubterranean vapour in that particular quarter, or other unknown cauſe.

All theſe phenomena denote a peſtilential cauſe in water as well as air. Whether that cauſe is a poſitive ſubſtance, infuſed into the elements from ſubterranean regions, increaſing the due proportion of oxygen; whether it is a negative ſtate of the elements, occaſioned by the abſtraction of oxygen; or whether it is occaſioned ſimply by a chemical alteration in the elements, by the me-

chanical operation of the electric fluid, which may produce new properties in air and water by means of new combinations of their parts, are questions not easily solved. But, without attempting to penetrate into the mysteries of nature, and unfold primary causes, we may be certain of their effects, and from this branch of knowledge may deduce useful conclusions.

We know, for we see, the effects of some mortal principle, which, at particular periods, destroys or impairs the usual powers of life through the animal and vegetable kingdoms. We rationally conclude that this cause must be general, affecting the elements of life over whole regions of the earth, and beneath the waters of the ocean. Of so much we are certain. As to the primary or remote causes we can only indulge a rational spirit of philosophical enquiry that may lead to probabilities.

Sydenham is among the most reputable authorities for the doctrine of a change in the properties of air from a subterraneous vapour. His words are, vol. i. p. 8, Wallis's edit. " There are various general constitutions of years that owe their origin neither to heat, cold, dryness, nor moisture, but depend rather on a certain secret and inexplicable alteration in the bowels of the earth, whence the air becomes impregnated with such kinds of effluvia as subject the human body to particular distempers, so long as that kind of

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conſtitution prevails, which, after a certain courſe of years, declines, and gives way to another."

The reader will recollect, that when the plague firſt broke out in Athens, the people alleged that the enemies had poiſoned their wells. In the mortal plague of 1349, the Germans ſuſpected the Jews had poiſoned the wells, and vented their rage upon the harmleſs Iſraelites. Theſe ſuſpicions, doubtleſs, aroſe from the bad quality of the waters, ſimilar to what was obſerved in New Haven in 1795; and the ſuſpicion of poiſon was full as well founded as the modern doctrine of importation.

The death of fiſh in rivers and the ocean is one of the ſtrongeſt arguments to prove the cauſe of peſtilence to be a ſubtle vapour, expelled or exhaled from ſubterranean regions. That fiſh do, in fact, die of epidemic diſeaſes, is a fact as well authenticated and as certain as that epidemic diſeaſes affect the human race; and it is equally certain that ſuch mortality among the fiſh is uſually contemporary with peſtilence among men on the adjacent ſhores. From theſe facts we are powerfully inclined to believe, the general cauſe which affects the one ſpecies of animals to be the ſame which affects the other ſpecies. This concluſion is eaſy, natural, and irreſiſtible.

What, then, can be the principle which penetrates the waters, and reaches the animal functions of fiſh and oyſters on the bottom of the ſea? Can

Can it be a vitiated ſtate of the ſuperincumbent atmoſphere? Can a deleterious principle, belonging to the air, find its way through a maſs of water, and deſtroy life as effectually as in its natural fluid on the ſurface of the earth? Theſe are queſtions I pretend not to ſolve. But I cannot help thinking that the only efficient cauſe, within our narrow comprehenſion, capable of extending the principle of deſtruction through the different elements is the all-pervading element of fire, or electricity. The *modus operandi* is among the impenetrable arcana of the phyſical world.

It may not be uſeleſs to introduce here an obſervation made by elderly people in America, that in ſickly years the Aurora Borealis does not appear. It is certain, that during the preſent peſtilential period, ſince 1790, that phenomenon has never been obſerved, at leaſt not in any diſtinguiſhed degree of brightneſs.

But the hiſtory of the Aurora Borealis does not warrant the juſtneſs of this obſervation as a general fact. The years 1564—5, which were diſtinguiſhed by northern lights, were ſickly in Europe, and in many parts raged the plague. The ſame lights were very ſplendid in November, 1575, a year when the plague was ſpreading over Europe with unuſual violence and mortality. The ſame were repeatedly obſerved in 1580, the year of a moſt ſevere univerſal catarrh, when the plague raged in Paris, and when Cairo loſt 500,000 people

ple by the ſame diſeaſe. Thoſe lights were again viſible in 1621, and deſcribed by Gaſſendus, in France, who, it is ſaid, gave them the name of *Aurora Borealis.* That year was noted for a moſt fatal epidemic ſmall-pox, and the Hungarian fever, in Europe; and the plague, which raged among the Indians in America in 1618, had not ceaſed in 1621.

From this time to the year 1707 we have no account of the appearance of theſe lights. In that year they appeared, but not of a remarkable brightneſs. If theſe lights appeared in this long interval, from 1621 to 1707, it is ſtrange that aſtronomers ſhould have left us no account of them. Certain it is, that the great Halley never ſaw this phenomenon till the year 1716, when he was ſixty years old, and he began to deſpair of ever beholding it. During this long ſuſpenſion of the Aurora Borealis, epidemic peſtilential diſeaſes occurred very often in both hemiſpheres.

In the ſame interval theſe l ihts were never ſeen in America; and our anceſtors, when they firſt beheld them at the beginning of this century, ſuppoſed them a new phenomenon in creation, the memory of them having been loſt.

In 1719, in November, appeared theſe lights, which was at the commencement of a ſickly period of great ſeverity and extent: the plague was then raging in the Levant. A ſplendid phenomenon of the ſame kind was obſerved in February, 1720,

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the moſt unhealthy year of that period. The ſame in the three following years, and in 1725, 1726, 1728, 1730; repeatedly in 1733, a ſickly period; repeatedly in 1735 and 1736, very ſickly years, when the mortal ſore throat prevailed; alſo in 1737.

From theſe facts we conclude, that the cauſe of peſtilential diſeaſes has no connection with theſe viſible phenomena of the electrical fluid, as they are obſerved indifferently in healthy or ſickly years. It is evident, however, that the *lumen boreale* is, in a certain degree, periodical.

Let us now attend to the effects of a peſtilential ſtate of air and water in the production of inſects and ſmall animals. This is one of the moſt remarkable ſymptoms of a ſickly ſtate of the elements; and it is more neceſſary to inſiſt on this phenomenon, becauſe it is viſible to every eye, and carries with it, during peſtilence, a demonſtration of the doctrines for which I contend.

In the threſhold of the hiſtory of plagues we meet with accounts of myriads of noxious inſects accompanying theſe calamities. The ten plagues of Egypt are numbered among the miraculous interpoſitions of Providence in favour of his choſen people. But, ſo far as regards moſt of the plagues, we find, by ſubſequent events, they are uſual occurrences during peſtilential periods. Such are ſwarms of inſects, called in Scripture flies and lice, and eſpecially locuſts; which at this day,

and

and in every age, are generated, in unhealthy periods, in ſuch numbers as to darken the ſun when on the wing, and which often devour every ſpecies of plants, and even the bark of trees. Theſe animals ſeem to have their origin in the deſarts of Arabia, bordering on Egypt and Syria; but they have often overſpread all Paleſtine, Judea, and Italy. Sometimes they have penetrated into Germany, Poland, and Ruſſia. It is unneceſſary here to enumerate the inſtances related in the foregoing hiſtory of the ravages of theſe animals: the reader has obſerved that inſtances of their appearance have often occurred in different periods, and that they are always the harbingers or the companions of the plague.

This fact leaves no room to queſtion, that the ſame ſtate of air in the oriental regions which will generate epidemic diſeaſes, will often produce thoſe animals in unuſual numbers. They do not, indeed, always attend the plague; the particular ſeaſons moſt favourable to their generation is an exceſſively dry one; but it is obvious, that they rarely appear in deſolating ſwarms, except in periods when the neighbouring countries are afflicted with mortal epidemics.

It is true that, in two or three inſtances, hiſtory informs us dreadful plagues have originated from the putrefaction of theſe animals—the inſtance of the peſtilence on the African coaſt, about 126 years before the Chriſtian æra, is

memorable. But while this fact is not disputed, we must observe that the same period was distinguished for pestilence in other countries, where no such local or particular cause existed. Great swarms of locusts, therefore, in the eastern countries, *may* be the cause of pestilential diseases, but always by accident; whereas, they are certainly the forerunners or companions of that calamity. —See the years 394, 590, 677, 1031, 1084, 1091, 1186, 1234, 1337, 1476, 1646 and 7. Also before the Christian æra, the locusts of the years 206 and 174.

In the destructive pestilence which almost extinguished the human race, in the reign of the Antonines, about the year 167, the earth was overrun with caterpillers.

During a most mortal period, about the year 590, an inundation deluged Rome, and such multitudes of serpents were brought down the stream and lodged on the Champaign country, as to occasion a great stench, and contribute to the subsequent mortality.

Worms and myriads of flies, and other noxious animals, are mentioned in the foregoing history as the attendants on pestilence. See the years 763, 1001, 1106, 1234, 1286, 1348, 1390, 1575, 1598, 1610 and 12.

Lord Bacon informs us, that during a plague in his time, there were found in the ditches and low grounds about London, a species of animals which

which he calls *toads*, with tails two or three inches long; a kind of animals, doubtlefs, which we often fee in ftagnant waters, but of larger fize. He remarks further, that "thofe years have been noted for peftilential and unwholefome, wherein there were great numbers of frogs, flies, locufts, &c."

Works, vol. iii, p. 166.

Ariftotle mentions the multitudes of frogs in fickly years.

Prob. fec. 1.

Horftius informs us, that unufual numbers of frogs, toads, locufts, cankerworms, mice, fnails, and fimilar infects, are the infallible figns of a peftilence. To thefe he adds an extraordinary abundance of fifh in the fea and in rivers.

See p. 253, *de pefte*.

The commencement of the prefent peftilential ftate in America was diftinguifhed by an unufual plenty of fhad, of which fourteen thoufand were caught at one draft of a seine near the harbour of New York. I have met with one or two writers, befides Horftius, who have mentioned this phenomenon as the prefage of peftilence, particularly Paracelfus, in vol. i. 168.

The plague of 1635 and 6 in Holland, was accompanied or preceded by an incredible number of infects, as gnats, butterflies, beetles,

wafps,

wafps, grafs-hoppers, but efpecially flies, which were fo numerous, as to cover the ceilings of houfes, and even to obfcure the fun in open air.

See Diemerbroeck, *de peste*, p. 10.

In the plague of Laufanne, in 1613, flies were in fimilar abundance.

Ibid.

The approach of the plague at Dantzick in 1709 was announced by incredible numbers of fpiders in the preceding year.

Baddam's Mem. vol. vi. 13.

The year 1633, which produced a peftilential fever among the fettlers at Plymouth in America, was remarkable for fwarms of large flies, which filled the woods with their humming founds.

In the month of Auguft, during a dreadful drought at Bengal in 1770, which cut fhort the rice-crops, and produced a terrible famine and fubfequent epidemic fever, the air was filled with a cloud of infects, of the fize of a horfe-ftinger, with a long red body and a large head; they continued to obfcure the fun for fome days, during which all toads, frogs, and infects on the earth difappeared; but this cloud in the air did not defcend to the earth. The next year a million of people perifhed with epidemic difeafes.

The prefent peftilential period in America was introduced by fuch multitudes of canker-worms

and palmer-worms, as were never before known. Moſkitos have been the harbingers and attendants on the diſeaſes in New-York and Philadelphia in 1793, 1795, and 1798. In this latter year the whole country has been overſpread with graſs-hoppers, which very much injured the meadows, paſtures, and gardens.

On theſe facts I will juſt remark, that they ſerve to confirm the hiſtorical truth of the ſcriptures. The whole ſeries of facts relative to the great plagues that have afflicted mankind, is a tiſſue of proofs that the hiſtory of the ten plagues of Egypt was written on the ſpot, and is a faithful record of facts. If the operations of nature are uniform, the Scriptures cannot be a ſpurious production. They deſcribe Egypt and Syria, as to every thing reſpecting climate and productions, preciſely as they are at this day; and this fact is alone ſufficient to eſtabliſh their authenticity, againſt all the infidels on earth.

It may be impoſſible to define preciſely thoſe qualities of air and water which favour the production of unuſual multitudes of any particular ſort of inſects. It has been cuſtomary for writers to aſcribe them to putrefaction in the air; an indefinite and unintelligible term. It is true, that moſkitos and ſome other inſects are generated in hot, moiſt, ſtagnant air, and in marſhy places, when the putrefaction of vegetable and animal ſubſtances is uncommonly rapid. But they are produced

produced in pure water alſo, without any apparent mixture of vegetable matter beyond what is common to all water.

Flies, on the contrary, are moſt numerous in a hot and dry ſeaſon. Moiſture is hoſtile to their exiſtence; and in the year 1795, when the rainy ſeaſon commenced about the 20th of July, preceding the fever in New-York, the flies almoſt wholly diſappeared, and were ſucceeded by moſkitos. Putrid ſubſtances are the food of flies, but the ſeaſon moſt favourable to putrefaction does not always produce flies in the greateſt numbers.

In ſhort, it is not poſſible to account for the myriads of inſects which appear in particular years, on any known principles of the animal economy, or any viſible properties of air and water. If unuſual numbers of a particular inſect appear periodically, as in caſe of the canker-worms, though I have not ſatisfactory evidence of the regularity of *their* appearance in uniform periods, we ſhould naturally conclude ſuch animals to paſs through other forms of exiſtence, and to re-appear in a particular noxious form at the end of definite intervals of time. But were this the fact, it would ſtill remain a problem of the moſt embarraſſing difficulty, to diſcover the reaſon of their appearance in unhealthy periods only. For ſuch is the fact with moſt of the inſects; and their tranſmigration, if admitted, will not in the leaſt help us to account for their exiſtence in

thoſe

thofe times only when the ftate of the air is unfriendly to human life.

But, in truth, as to moft of the noxious infects which mark periods of epidemic difeafes, we know them not to change their forms of exiftence, nor are the times of their appearance periodical. On the other hand, we obferve they appear in fickly periods, and in unufual numbers at no other time. We conclude, therefore, that a ftate of the elements, unfriendly to the health of man is favourable to the generation of noxious infects; but without attempting to explain the particular properties of the elements which poffefs that prolific power *. All I contend for by thefe facts is, that the peftilential principle, whatever may be its nature or properties, is a general principle, affecting all the elements of life, and that to this general caufe are we to afcribe the deleterious difeafes which at times fpread over extenfive regions of the earth. Under this juft and philofophical view of the fubject, infection finks to a very trifling confideration among the caufes of epidemic diftempers.

The order in which infects and difeafes appear is not uniform; but it ufually happens that the infects are the firft in order of time. This was the fact in 1770, when the flies clouded the heavens in Bengal, and the worms darkened the

* May it not be the force of excitement occafioned by electrical operations?

earth

earth in America. Such was the fact in 1791, when canker-worms in June gave to our orchards the aſpect of winter. But the whole progreſs of epidemics is more or leſs marked by noxious and troubleſome inſects.

If we attend to the ſtate of a peſtilential air, in reſpect to its effects on inanimate objects, we are furniſhed with further proofs, that epidemic diſeaſes are the production, not of fomites from the ſick, but of a general deleterious principle.

A remarkable inſtance of the corrupt or defective ſtate of air happened in the mortal plague of the year 252. See the deſcription of it under that year. It covered objects with what the hiſtorian calls "*ros tabidus*," a putrid or corrupt dew or mould. A ſtate of air ſo extremely imperfect muſt have been utterly inſufficient to ſupport healthy life in the animal ſyſtem.

The air of New York, in 1795, produced aſtoniſhing effects in the generation of mould, and the rapidity in the proceſs of putrefaction in fleſh and vegetables was almoſt incredible.

The fatal angina maligna among cattle, in 1682, was attended with a blue miſt or dew on the herbage of paſtures.

See the deſcription of it under that year.

It is not an unfrequent thing, that a viſible and offenſive miſt or fog ariſes in places during the rage of peſtilential diſeaſes. Such a miſt

aroſe

arofe and fpread over Dantzick in Auguft 1709, during the plague. This fog was fo thick as to darken the air for fome time, and had a very offenfive fmell.

Baddam's Mem. Vol. vi. 14.

Schreibner, cited by Van Swieten, vol. xvi. mentions, that a fmall cloud often hangs over the infected place. It is fuggefted by that able author, that the contagion collected into fuch a cloud, may be difperfed by winds, and afterwards collect at a different place. It is, however, more probable, that fuch collections of impure vapour are produced where they exift; and that if once difperfed, the particles are not afterwards collected. The phenomenon, however, is no inconfiderable evidence that a peftilential ftate of the atmofphere is caufed, or increafed, by vapours exhaled from the bowels of the earth.

In the mortal peftilence at Rome, A. U. C. 576, Livy mentions a bow extended over the temple of Saturn, three mock-funs, and in the evening following many tranfient meteors.

Lib. xli. 21.

A fimilar fog or vapour during eafterly winds appeared in New York, in September 1798, in the moft fatal period of the plague. Perfons who felt and faw it, defcribe it as moft difagreeable to the fenfes; and its effects were very remarkable. The pavements of the ftreets, and other

other objects, were covered with a coat of dew, or mould, not however exactly resembling either of those substances; not unlike perhaps the "*ros tabidus*," or "*ros sanci similis*," of the year 252. Its effects were equally wonderful on the leaves of trees, which were covered with spots, which appeared as if corroded by an acid. And I have seen a cotton garment which had been washed and hung out on the night of the fog, which was also covered with spots of a dark grey colour, and which could not be taken out by any process of washing. During this period also, iron-railings and pump-handles were suddenly covered over with scales of rust, or a ferruginous colour. These phenomena correspond with the effects of the pestilential air at Oczakow in 1739, in which surgical instruments became livid or black, as did the silver hilt of a sword.

These recent facts, which have come under my own observation, have enabled me to give due credit to historians, who mention spots in garments appearing suddenly during the plague. The writers who mention this phenomenon were mostly monks, or other ecclesiastics whose relations are highly tinged with superstition; and as their imaginations have usually wrought up these appearances into the figure of a cross, or other chimerical form, and ascribed to them some miraculous qualities, I had passed over the passages with very slight consideration.

I have

I have however tranſcribed, or rather abridged, one of theſe accounts, under the head of plagues in the reign of Juſtinian. It is from Warnefred, who relates, that in the peſtilence at Liguria, the Genoeſe territory, there appeared ſuddenly "*quædam ſignacula*," certain ſigns or ſpots on doors of houſes, garments, and utenſils, which could not be waſhed out, but grew brighter by waſhing. See the account in the foregoing hiſtory under the deſcription of the plagues between 542 and 600. I recollect reading ſeveral other accounts of ſimilar phenomena, which, for the reaſons juſt aſſigned, I neglected to tranſcribe when the authors were before me, which I now regret.

The celebrated Boyle mentions ſimilar phenomena during peſtilence, and particularly an inſtance in Naples, in the year 1660, which happened after an eruption of Veſuvius, and which he aſcribes to a vapour. The vapour, he remarks, made impreſſions of curious figures on garments; and he cites Thuanus and Kircher as authorities for his opinion.

See Vol. v. p. 60.

In the dreadful plague of 746 ſimilar figures appeared on the garments of people, which the writer calls *cruciculæ*, little croſſes, which ſeemed as if drawn in oil. Theſe marks excited no ſmall terror wherever they appeared.

Paulus Diaconus. Aug. Hiſt. 1012.

These phenomena indicate a peculiar state of the air which is not common even during pestilence. It is a state which marks the highest degree of derangement in its ordinary healthful qualities, and such as, blessed be God, does not often occur.

Another strong proof of the doctrine here maintained of a pestilential principle in the elements, is the well-known fact, that, during the plague, fowls abandon the atmosphere of the infected places.

Livy mentions, that in the terrible plague at Rome, *Anno Urbis Conditu* 571, not a vulture was to be seen for two years.

Dr. Gottwald remarks, that in the Dantzick plague of 1709, sparrows, daws, storks, and swallows, deserted the place for four months. Dr. Schelwig has recorded a similar fact; and Storbait affirms that birds deserted Vienna during the plague. Those kept in cages died.

Diemerbroeck has informed us, that in the Holland plague of 1635 and 6, birds were unusually rare. He remarks, that birds more readily perceive the poisonous state of the air, and change their residence to places more salubrious, even abandoning their nests and their young. The same fact has been observed by many medical and historical writers.

The ancient physician and compiler of medical science, Ætius, mentions among the signs of approach-

approaching peſtilence the death of birds and quadrupeds. If, ſays he, the circumambient air is the cauſe of the diſeaſe, it will firſt ſhow its effects in deſtroying birds; if vitious exhalations from the earth are the cauſe, quadrupeds will be firſt affected.

The fact goes to demonſtrate, that the peſtilential principle pervades the aërial fluid, and is offenſive to the delicate organs of fowls. It may be further mentioned, that the deleterious principle is often fatal to ſmall birds in cages, before it is perceived by the human race. It is a curious and well authenticated fact, that in the progreſs of a plague, in cities, ſmall birds ſicken and die: and not long after, the people in the ſame houſe are ſeized with the peſtilence. Diemerbroeck was frequently an eye-witneſs to the fact; and he obſerved, that wherever the ſmall birds died in cages, the plague never failed, ſome time after, and often in two or three days, to attack the inhabitants of the dwelling. This is another proof, amounting to demonſtration, that the peſtilential principle is a quality of the atmoſphere, and that it is *progreſſive in its malignity*, having little or no dependance on the powers of contagion.

See Diem. de peſte. p. 11.

After all, the cauſe of violent and deſtructive epidemic diſeaſes may remain a ſecret. We ſee

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the cauſes of the ordinary diſeaſes of the ſeaſons in marſhes, ſtagnant waters, confined air, and the like; but it often happens, that peſtilence commits moſt cruel ravages in ſeaſons apparently the moſt temperate, and in places evidently the moſt ſalubrious.

The plague in 542, and in ſubſequent periods of the fifty years plague of Evagrius, aſcended to the tops of the hills and mountains. The terrible plague of 252, in the reign of Gallus and Voluſian, invaded every village and every houſe. The deadly plague of 1348 penetrated likewiſe to the moſt healthy ſpots on the globe, and even to the regions of Greenland, ſweeping away the human race with undiſtinguiſhing ſeverity.

Hildanus informs us, that in the plague of Lauſanne, in 1613, the huts of the peaſants on hills and mountains were not exempt from the malady, though detached, and having no intercourſe with the infected. The ſame fact is recorded of the plague in 1720, which extended to the villages and mountains of Provence.

In the *Traité de la peſte*, p. 29, it is aſſerted, that in the melancholy plague at Lyons in 1628, the filthieſt houſes, the crowded places, narrow ſtreets, and confined apartments, were places of the moſt ſafety; while the moſt airy ſituations, as houſes on hills, were moſt expoſed to the ravages of the diſorder. No place was exempt—the change of air was uſeleſs or pernicious; in ſome

caſes,

cafes, thofe who enjoyed health in the impure air of the city, on removing into the country were attacked with the malady. Malouin declares, that the moft populous and dirty places in Lyons and Marfeilles were leaft affected with the plague.

Thefe facts are very fingular, yet it is not difficult to account for them on the principle of a fuperabundance of oxygen, ftimulus, or principle of life in the atmofphere. If, as is fuppofed, a ufual caufe of peftilential diforders is a too great quantity of oxygen in the air, producing firft the ftenic or inflammatory diathefis, and of courfe indirect debility, then thofe places muft be moft healthy, in fuch a general ftate of the air, where there is the fmalleft proportion of oxygen. This remark, however, is a mere conjecture; and the facts related of the plague in Lyons, ftand as an exception to a very general rule, that the moft filthy, unventilated places, fuffer moft feverely by all kinds of peftilential maladies *.

It is alfo true, in general, that the poor, who inhabit narrow ftreets and alleys, amidft filthy fubftances, fuffer more by malignant complaints

* In Lyons, tanners and curriers efcaped the plague, as did thofe who cleanfed fewers and privies. The fame has generally been the cafe with the fextons and others employed in burying the dead. See Lancifius, p. 160. In London, fhipwrights, who laboured in the vapour of tar and pitch, efcaped.

than the rich, who live in wider ſtreets and more airy cleanly houſes. To this, however, hiſtory preſents us ſome exceptions; caſes have occurred in which the rich have been the principal ſufferers, as in 1361.

While it may be difficult to aſſign preciſe reaſons for ſuch differences in the operation of the principle of deſtruction, the facts prove that this principle conſiſts in ſome hidden qualities of the elements, and does not ariſe from any of the ordinary viſible cauſes of diſeaſe.

Riverius is explicit on this point. He avers, that peſtilential diſeaſes often occur without any apparent change in the viſible qualities of the air, and when the air appears to be more pure than at other times, when no ſuch diſeaſes prevail.

Lib. xvii.

Further, although it is generally true that peſtilence is attended, and greatly augmented in violence by ſome peculiarity in the ſeaſons, as exceſſive heat and moiſture, or drought, yet to this there are frequent exceptions. The reader may turn back to an inſtance of this recorded by Livy and other Latin hiſtorians, in which it was remarked, as a matter of ſurprize, that a violent plague, and one of the moſt deſtructive kind, ſhould aſſail the city of Rome in a mild temperate ſeaſon. A ſimilar obſervation was made reſpecting the plague in Paris in 1580. The

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summer was temperate and the fruits good. No visible cause could be assigned for the malady. Yet a most certain, or rather an infallible symptom of a deranged state of elements, had occurred in that year; I mean a most severe universal influenza. Hence it appears, that although peculiar seasons may prodigiously increase, and perhaps produce a pestilence, yet the general cause is often some principle which has no dependance on seasons or changes of the weather. In the last London plague in 1665, says Hodges, the season was mild, the heat moderate, and fruit abundant and good.

We have in America proofs of the truth of this doctrine. The late pestilential periods commenced with the measles in 1789, and severe epidemic influenza in 1789 and 90, and has already continued nine years. Some of the summers, during this period, have been very temperate, as those of 1794 and 1797. Yet every summer has produced the pestilential fever of our climate; and even our winters have exhibited symptoms of the diseases which prevail in summer. Not one year, even the most temperate of the whole period, has failed to show the predominant diathesis of the pestilence. The sultry dry summer of 1793 and 98, and the sultry humid summer of 1795, have rendered the diseases more violent and fatal in the northern States.

Yet in the more favourable feafons of 1794, 96 and 97, the morbid caufe produced its effects in New Haven, Providence, Newbury-port, and Bofton, as well as in Baltimore, Norfolk, and Charleftown.

Hence we obferve, that the elemental caufe of the difeafes of this period, may be in fome degree modified, but not controlled or fubdued by the moft temperate and favourable feafons.

Indeed all writers of reputation on this fubject agree in this one opinion, that the plague cannot be afcribed either to intemperate feafons, or to putrefaction, or to any fpecies of exhalations from animal and vegetable fubftances. Thefe are allowed to be fecondary caufes, operating to modify or vary the operation of the primary caufe; but one uniform feries of obfervations, from the beginning of hiftory to this day, has driven medical writers from the defencelefs ground of intemperate weather and putrid exhalations.

Hippocrates learnt that peftilence could not be afcribed folely to vifible caufes: he therefore admits *to theion*, fomething divine, or beyond human inveftigation, to be a primary caufe of this calamity.

Tacitus informs us that the plague, in the time of Nero, could not be afcribed to any vifible intemperature in the feafons.

Fermelius obferves, that although immoderate heat augments the plague, and every acute dif-

eafe,

caſe, yet he had known an exceſſively hot ſeaſon paſs off without producing peſtilential diſeaſes. He agrees with Diemerbroeck, that the cauſe muſt be ſome unknown principle; " *inguinamentum e cœlo demiſſum*;" ſome cauſe of corruption in the atmoſphere, which is infuſed into it from the celeſtial regions. This is cutting the gordian knot. Theſe authors are doubtleſs right in rejecting the viſible qualities of the air, exhalations and intemperate ſeaſons, as the primary cauſes of the plague; but they fly from the earth into the boundleſs regions of ſpace for a cauſe which is more probably beneath their feet, or around their bodies.

Sennertus decides alſo moſt poſitively againſt putridity or corruption of the humours as the cauſe of peſtilence; and maintains, that it proceeds from an occult malignity in the air.

Stenkius contends that perſons do not receive the plague from humours in the body; from extraordinary ſeaſons; from inteſtine putridity, or corruption of indigeſted ſubſtances; nor from bad food or drink; nor from ſtagnant waters; nor from exhalations from dead bodies, cemeteries or ſewers; or the fetid waters of tan-yards, unleſs they inhale the noxious or infecting cauſe, *e ſublimi*. To produce the malady requires no corruption of the manifeſt qualities of the air.

Page 764.

Proſper

Profper Alpinus, who lived fome time in Egypt, and had an opportunity to make perfonal obfervations on the difeafes of that country, maintains that the plague rarely arifes from corrupt air, and never, unlefs when the Nile has exceeded its ufual limits in its inundations. If, fays this writer, the difeafe proceeded from noxious exhalations, from putrid ftagnant waters and marfhes, it would occur every year, which is contrary to fact. Hence he concludes the difeafe to be ufually imported into Egypt from Greece, Syria and Barbary. In this opinion he has been followed by a whole tribe of unobferving travellers, who ftupidly forget, that by tracing the diftemper from Egypt to Syria, or Barbary, they never come nearer to its fource. The queftion ftill occurs, what is its caufe? Where is its fource? If putrid exhalations in Egypt will not produce the plague, will fuch exhalations in Syria or Barbary produce it? Why trace it to thefe countries? Does any caufe exift in Syria, Greece, or Barbary, to generate that difeafe which does not exift in Egypt?

To avoid this dilemma, fome writers infift that its fource is in Conftantinople, where the feeds of it are treafured up in old clothes, and preferved from year to year, and from age to age. But why fuppofe this fource of the difeafe to exift in Conftantinople only? Why not the fame fource for ever exift in Egypt, for there alfo

alſo infected clothes are never purified. In ſhort, from Proſper Alpinus to Mead and Cullen, all the reaſonings and aſſertions of authors on the origin of the plague, argue either impotence of mind, want of obſervation, or extreme prejudice.

So far as this, Alpinus is right, that exhalations alone, from ſtagnant waters and marſhes, will not ordinarily generate the plague; but aided by ſome general primary cauſe in the elements, ſuch exhalations do produce the plague, and in no country more frequently than in Egypt.

Gibbon alleges this diſeaſe to proceed from hot, damp, ſtagnant air, drawing this concluſion probably from the origination of the terrible plague of 542, in the foul regions near Peluſium in Egypt, and in the vicinity of a large marſh. But if this were the only cauſe neceſſary to produce the diſorder, as Alpinus juſtly obſerves, it would occur regularly every year, for every hot ſeaſon generates putrid exhalations in ample abundance; and in every hot climate will be found annual returns of hot, damp, ſtagnant air. The cauſes therefore aſſigned by Gibbon are inadequate to the effect.

In America, beyond almoſt any other country, we have the moſt irreſiſtible arguments againſt this opinion. No country on earth, not excepting the rice plantations on the river Bengal, preſents ſuch an immenſe region of

ſtagnant waters, and fetid marſhes, as the eaſtern ſhores of the United States from the Delaware to Florida. The ſouthern extremity of this region is in a climate always warm; and the whole of it expoſed to burning heat for four months in the year. Yet the true "*peſtis inguinaria*" of the oriental countries, has never appeared in this country as an epidemic; and the ſpecies of the plague which occurs, and which I call bilious or *American*, appears as rarely amidſt the marſhes of Carolina, as in the northern cities, which are expoſed to no marſh or exhalations.

Now, if hot, damp, ſtagnant air, and putrid exhalations alone were adequate to the production of this bilious plague, it muſt be produced every year in a multitude of places on the American coaſt; whereas, in fact, that diſeaſe rarely occurs as an epidemic, even on the flat lands of Carolina and Georgia, and never is very extenſively mortal, except when the northern States, which are ſituated on high, rocky, gravelly, and dry lands, and whoſe air and water are of the moſt pure and ſalubrious kind, are afflicted alſo with malignant epidemic diſtempers.

This is a remarkable fact, and one on which I will venture to reſt the whole argument. In no inſtance has the city of Charleſtown, ſituated on an immenſe flat, ſurrounded by the marſhes of Aſhley and Cooper rivers, been ſeverely troubled with a contagious bilious epidemic, except when the

the ſeaſons have been ſickly in the northern States. Witneſs the years 1699, 1728, 1732, 1739, 1745, 1748, 1796. I ſpeak not of ſporadic caſes among ſtrangers that viſit the ſouthern States, for theſe may occur every year.

The Europeans might, had they not been blinded by the falſe notions of contagion, long ago have diſcovered the ſame important truth; for what is called a great plague in Egypt or Syria never occurs, except during the prevalence of malignant epidemics all over Europe, even to the Baltic. Lighter epidemics occur in Egypt or Conſtantinople in any uncommon ſeaſon, and ſo does the ordinary autumnal bilious fever in all our ſouthern States. Theſe are diſorders which may be excited in any place and any ſeaſon, by the action of heat on vegetable ſubſtances in ſtagnant water, or by the local impurities which always exiſt in populous cities. But theſe ordinary diſeaſes do not put on the malignant ſymptoms which characterize the diſtempers of peſtilential periods; they do not exhibit infection. On the other hand, when the diſeaſes of Egypt aſſume contagious and deadly ſymptoms, and ſpread deſolation over that country, we ſhall always find the northern parts of Europe more or leſs afflicted with the ſame or other malignant diſorders. The peſtilential principle, in greater or leſs degrees of violence, extends over

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the whole European world, and not unfrequently over the American continent.

Thus, although the plague does not in modern times appear in the North of Europe, at leaſt not often, yet all the great plagues in the Levant are viſible, if I may indulge the expreſſion, in the augmented Bills of Mortality in London, Amſterdam, and the Baltic cities. Witneſs the peſtilential periods of 1720, of 1736 to 1740, of 1760 to 1763. Even the leſs violent peſtilences of 1772 and 73, and of 1784 to 1786, have been marked by epidemics in England and Scotland. And in the laſt ſeries of epidemics, the years 1792, 93, and 95, which have been diſtinguiſhed for the plague in the Eaſt, as well as anginas and plague in America, exhibit a conſiderable encreaſe of mortality in London.

All theſe facts ſerve as the evidence of the truth of what the medical writers of the fifteenth, ſixteenth, and ſeventeenth centuries have unanimouſly advanced, that the primary cauſe of peſtilence is ſome inviſible quality in the elements, altogether diſtinct from corrupt air, or marſh exhalations.

It is a remark of the Arabian phyſicians, that an indiſpoſition of the air is neceſſary in the hotteſt climates to enforce the action of putrid effluvia on the human body to produce the plague.

Mead, 248.

Dr.

Dr. Mead himſelf, while he maintains that the putrefaction of animal ſubſtances, with unſeaſonable moiſtures, heats and want of winds, produces the plague, and while he contends that no kind of putrefaction in European countries is ever heightened to a degree capable of producing the true plague, admits that a corrupted ſtate of air is neceſſary to give the contagious atoms their full force, otherwiſe the plague could never ceaſe but with the extinction of mankind. That is, he holds the plague never to appear in European northern countries without contagion; but that the contagion would remain inert without a corrupt ſtate of the atmoſphere.

The abſurd opinion that the northern climates will not generate the ſtate of air which occaſions a peſtilence, but that a peſtilential germ or leaven muſt be imported from Egypt or other ſouthern latitude, has been adopted by moſt of the Britiſh medical writers, and by a numerous part of the phyſicians in the United States. It is hard to ſay whether the followers of Mead are the more ſervile, or their opinion the more unphiloſophical. But, for my preſent purpoſe, it is ſufficient that even the advocates for the propagation of the plague by a ſpecific contagion admit that this cauſe is not adequate to the effect, and that they are compelled to ſummon to their aid a general principle of corruption in the air to account for its propagation in northern climates.

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This conceſſion of the exiſtence of ſuch a principle, by whatever name it may be called, is all I aſk.

It is on this principle only we can reconcile the different accounts of authors in regard to the effect of putrefying bodies after battles in producing peſtilential diſeaſes; ſome alleging that ſuch corrupting bodies will produce the plague, and others denying the fact. Julius Alexandrinus, Diodorus Siculus, and other authors relate, that plagues have ariſen from the putrefaction of dead bodies after battles. Three or four inſtances occur in the foregoing hiſtory of plagues aſcribed to the putrefaction of dead locuſts. Foreſtus relates, that a dead whale, caſt upon the ſhores of Holland, occaſioned an extenſive peſtilence in Egmont.

See Hieronymus, Auguſtinus, Sabellius, Walſius, Angelus, Paræus and Agricola, who have recorded ſimilar facts, as cited by Diemerbroeck, *De Peſte*.

Dr. Gottwald relates, that the plague which ſpread over the North of Europe from 1702 to 1711, originated near Pickzow, ſoon after the unfortunate battle between the Saxons and Swedes; but he ſays nothing of putrefying bodies; nor does he aſcribe the diſeaſe to that cauſe.

Baddam's, Mem. 6, 5

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At the ſame time it is equally true, that thouſands of dead bodies, after battles, have periſhed unburied without producing any ſuch effect. In 1642 eight thouſand dead ſoldiers, and innumerable carcaſſes of horſes, after a battle in the Duchy of Juliens, were left to putrefy on the ſurface of the earth, cauſing an intolerable ſtench, but producing no peſtilential diſeaſe. The ſame fact happens often ſays Diemerbroeck, p. 31, in the cruel wars between the Swedes and Imperialiſts in his days; and we know that other hiſtorians have related ſimilar facts.

Whenever a malignant diſeaſe follows ſuch an extenſive putrefaction, Diemerbroeck alleges the diſeaſe to be only a peſtilential fever, but not the true plague. Or if in any inſtance the true plague follows, he maintains the putrefaction to be only a ſecondary cauſe. This is probably a near approach to the truth. The whole myſtery is unfolded on my principles, which teach the exiſtence of a diſordered or peſtilential ſtate of the elements at particular times. If the putrefaction of dead bodies takes place during theſe periods, when the animal functions are debilitated or impaired, and the human body prone to diſeaſe, the corruption of fleſh may ſo far vitiate the atmoſphere as to produce peſtilence. But if thouſands of dead bodies putrefy on the earth when the air is in its natural ſtate, ſalubrious and adapted to the ſupport of health, and when the

human body is in full vigour to resist the effects of the foul effluvia, it is hardly possible for any quantity of dissolving flesh to evolve a poison adequate to the production of pestilential disorders, and certainly not sufficient to occasion an extensive epidemic.

An attention to this distinction will also reconcile all the differences of opinion, and all the contradictory phenomena which regard the effects of vegetable effluvia, and the impure air of cities.

Why, it has been triumphantly asked by the advocates of imported fomites, did not the filthy streets, and putrefying vegetables of New York and Philadelphia produce the bilious pestilence in former years? For many years we recollect more foul streets and docks; much greater accumulations of filth, yet these produced not the contagious fever which has lately desolated our cities.

Such are the facts, I admit, and the same will again take place when the period of pestilence shall be closed, and the latent disorders of the elements corrected. But there has existed since 1789 a universal defect in the healthful powers of the elements, clearly evidenced by a series of severe epidemics, the influenza and scarlatina, the increased violence of the symptoms of ordinary distempers; by the imperfection of fruits; by the sickness and death of fish, fowls, and cats, with many disorders among other animals. The moment

ment this ſtate of the elements occurs, the local impurities which always exiſt in cities, and which produce only ordinary diſeaſes in a healthful diſpoſition of the elements, give to thoſe diſeaſes new virulence and a contagious quality. The whole ſecret to be unfolded is, that the autumnal diſeaſes, under the debilitating operation of a general derangement of the elements, acquire unuſually ſevere ſymptoms, a wider extenſion, and the quality of contagion, or what I call infection. Theſe phenomena excite the aſtoniſhment of men who have not attended to the hiſtory of peſtilence, in which they might have found the means of ſolving the difficulty; for ſimilar facts have marked the progreſs of peſtilential diſeaſes from the days of Moſes to this hour.

I would further obſerve, from univerſal obſervation it appears, that during that ſtate of air which produces contagious diſeaſes in unuſual numbers, all kinds of fleſh and vegetables are more apt to putrefy than in a healthy ſtate of the atmoſphere. This was obſerved by Diemerbroeck in the Holland plague of 1636, and we have had many proofs of it in America within a few years paſt. And this is evidently true, not only of freſh animal meat, but alſo of ſalted meats of all kinds. The powers of ſalt appear to be inſufficient to preſerve fleſh and fiſh againſt the ſtrong tendency to diſſolution which ſeems to attend them in certain years. Hence we ſo frequently

hear of ſpoiled beef and pork, and fiſh, during ſickly periods. In ſome ſeaſons it appears to be almoſt impoſſible to keep proviſions deſtined for foreign market. This effect on fleſh and fiſh may proceed either from unuſual heat and moiſture in the air, or from an obvious imperfection or ſickly ſtate of the animals; and perhaps, independent of theſe cauſes, it may proceed ſometimes from the ſame inviſible principle in the properties of the air, which originates new and malignant ſymptoms of diſeaſe in the human body; a mere exceſs of ſtimulus.

But whatever may be the cauſe, the effect is obvious; and the unexpected putrefaction of ſalted meats has often been among the cauſes which have generated or augmented peſtilential diſtempers in America. Such an inſtance is mentioned at New Haven in 1794, where a quantity of putrid fiſh was thrown into the dock, and was exceſſively offenſive juſt before the appearance of the peſtilential fever. In New York, the laſt ſummer, the peſtilence evidently received great force and malignancy from large quantities of beef and pork which ſpoiled in ſtores and cellars. A ſimilar cauſe is ſuppoſed to have excited or increaſed the ſame diſeaſe in Boſton and New London. The putrefaction of the remains of great multitudes of the fiſh called menhaden, on the wharfs in Newbury Port in 1796, was obviouſly

viously a powerful exciting cause of the disorder in that town.

In such cases putrefaction is more rapid, and its stench more poisonous than under a healthful constitution of the atmosphere. This accelerated dissolution of flesh is the *effect* of the common principle of disease, and in its turn becomes the *cause* of disease.

Hence we may observe, that it is only during a sickly state of the elements that putrefaction is ever known to excite pestilential epidemics; for almost every man has observed many times, that the same quantities of putrefying flesh in periods of health produce no such distempers. It is this circumstance which has puzzled all superficial observers, and furnished the advocates of imported infection with strong ground to maintain their errors. They allege "the same causes have not always produced the same effects. As putrefaction and filth have not at other times, and always, produced diseases in our climate, therefore they do not produce the pestilential fever of the present time, and it must be occasioned by imported fomites." These men have not attended to similar facts in all other countries and in all ages. The same argument would prove that no pestilential disease can be generated any where; for it is as true of the West Indies, of Egypt and Constantinople, as it is of the United States, that putrefaction does not every year, and

at all times, produce pestilence. In this fact agree all authors who have written on the causes of the plague. And there is reason to believe with Diemerbroeck, that putrefaction *alone* never produces the plague; but that whenever it is the *apparent exciting cause*, there concurs with it a general sickly state of the air; which not being visible, mankind ascribe the whole effect to putrefaction.

In the United States it is a very curious fact, that this sickly state of the elements has been progressive, as I have particularly proved in the preceding pages, which progression was clearly marked by the increase of mortality, by the scarlatina, and other diseases of unusual malignity. In every instance, the epidemic pestilential fever, though said to arise from putrid flesh, has kept pace with this insalubrious state of air. For example, while Philadelphia was ravaged by the plague in 1793, the scarlatina was prevalent in New York; but the eastern States were exempt, and felt no inconvenience from the pestilential state of the air, unless in a few sporadic cases of autumnal fever, of augmented violence, which indicated a *commencement* of the epidemic constitution. In 1794, this constitution arrived to its crisis in Connecticut, moving eastward in its progress; and in New Haven appeared the pestilential fever soon after its precursor, the scarlatina. Now, whether we suppose the pestilence to

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be from imported fomes, or from the putrid fish and clams in the docks, it is remarkable, that it did not occur till the state of air was evidently sickly and ill-fitted to support life, as appeared by the malignant dysentery in the vicinity, and by the universal prevalence of scarlatina. This is a curious and important fact.

Proceeding eastward, we observe the same truth. The pestilential fever at Newbury Port was said to be excited by the putrid garbage of fish—true, but this effect did not take place in 1793, when the fever was laying waste Philadelphia; nor in 1795, when the same fever prevailed in New York. Why? evidently because the constitution of air in the eastern States had not then arrived to its crisis of malignity. But moving eastward, the scarlatina began to show itself in 1795, and in 1796 was more general and fatal in all the adjacent country. Then followed the pestilential fever, both in Boston and Newbury Port.—So if we admit the disease to be of imported origin, or suppose it to arise from putrid exhalations, we are still compelled to admit the concurrence of some general cause in the production of the disease, because we never know this pestilence to appear but when other diseases and phenomena demonstrate the existence of such a cause.*

With

* If it should be said, that putrid fish might not have existed in other years in situations to expose the inhabitants; I answer,

With respect to the duration of this general constitution of air, we can determine nothing but by the event. We observe in history, that such pestilential periods are of various lengths, from three to fifteen years, or perhaps for a longer time; during which diseases are multiplied and augmented, and all bearing some peculiar symptoms that characterize that constitution or state of the elements. On this subject the treatise of Sydenham is invaluable.

There remains one other view of this subject to be considered in this section—this is the connection of pestilential diseases with famine.

Most authors have remarked that famine is a cause of pestilence, and have cited the old Greek adage, "*o Coimos meta limon, pestis post famem,*" the plague follows famine.

It is a just remark, that the true plague often follows a dearth of provisions; it is more frequently true, that scarcity is followed by diseases of a less malignant type. But it is equally true, that this order is often inverted and famine follows pestilence. It is more frequently true, that pestilence is neither preceded nor followed by any scarcity of provisions. Instances of all these facts

I answer, that within my observations, in numberless instances, immense quantities of the entrails of fish are left to putrefy on the shores of our rivers every year, with an intolerable stench, but without producing the least appearance of disease.

appear

appear in the preceding hiſtory. The concluſion is inevitable, that the plague proceeds from ſome other cauſe than a deficient or ſuperabundant quantity of food, for it often occurs independent of either of theſe circumſtances.

Thus Morellus, de feb. peſt. lib. 3, relates an inſtance, where no peſtilential diſeaſes ſucceeded a ſevere famine. Galen mentions an inſtance of a ſevere famine which followed a ſevere plague in Rome, yet the famine did not again excite the plague.

De Pauw, in his Philoſophical Diſſertations on the Egyptians and Chineſe, vol. i. 87. anſwers and refutes the Abbe Fourmont, who alleged famine to be the cauſe of the plague. "By exact annotations," ſays De Pauw, "continued during twenty-eight years, we find the plague has raged in Egypt five times without being preceded by any ſcarcity of food, and, contrary to what I once ſuſpected, unreſtricted to a periodical courſe." We know alſo in America, that ſcarcity of food can have had no influence in producing the numerous epidemic and peſtilential diſorders of the laſt nine years.

On this ſubject Diemerbroeck has a very juſt remark, and one that ſolves all the difficulties that might ſeem to ariſe from the differing accounts of the effects of famine. He ſays, "*Non omnem, ſed illam tantum famem ſequiter peſtis, quæ fames et ipſa a peſtilentiæ cauſa originem*

4 *ſumit*

sumit (dum ab ea causa primo fruges terræ corrumpuntur, postea pestis inducitur) ita ut fames illa non sit causa pestis, sed ipsamet eandem cum peste causam habeat."

De peste, p. 30.

"For the plague does not follow every famine, but that only which arises from the same cause as the plague, (for by that cause the fruits of the earth are first vitiated, and afterwards the plague succeeds) so that the famine is not the *cause* of the plague, but proceeds itself from the same cause."

Whenever there exists a general cause in the elements, unfriendly to the health of the human race, and at the same time to the growth and perfection of grain, pestilence and famine may be companions of each other; or they may reciprocally follow each other, according as the general cause operates first on vegetables, or on mankind. In such cases, superficial observers are apt to suppose one to be the cause of the other, when in fact, they are both the offspring of a common cause. In long sieges, bad food is often a powerful cause of disease, as in the siege of Marseilles by Julius Cæsar, before Christ 48.—Cæsar de. bel. Civ. lib. ii. 20.—In such cases, the bad qualities of the corn or bread, are not natural defects in the growth, but the effects of age, heat, moisture, and decay.

Fortu-

Fortunately, the improved ſtate of agriculture has rendered a dearth of grain a rare occurrence. In deſpotic governments, where induſtry of every kind languiſhes, and men ſeldom make proviſion for ſubſiſtence beyond the paſſing moment, famine is not unfrequent in modern times, as in Syria after the terribly ſevere winter of 1756—7, when the crops failed, and parents devoured their children, or offered them for ſale in market to procure food. But ſuch is the ſtate of agriculture in free countries, that crops are leſs liable to fail than formerly; and when they fall ſhort in a particular country, commerce may uſually ſupply the deficiency from ſome other climate. A univerſal failure of grain, even under the moſt unfavourable diſpoſition of the elements, muſt be a rare phenomenon.

Yet with all our improvement in agriculture and commerce, we are not to calculate with certainty that we are never to feel the ſcourge of famine. There has been, within about a century, a ſucceſſion of ſeaſons when the earth failed to yield her accuſtomed quantity of vegetable food. Such were the laſt years of the laſt century, when corn was cut ſhort by mildew and blaſt, not in one country only, but in moſt countries. Multitudes periſhed in the north of Europe, and our forefathers in America obſerved, that for a number of years the very courſe of nature ſeemed to be altered.

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The beginning of the seventeenth century was distinguished by a still more extensive and severe dearth, which afflicted all Europe and cut off a large portion of its inhabitants.

In the year 1783, the dearth in Scotland was so severe that commerce alone saved thousands from perishing; and so late as the year 1790, our own country experienced a scarcity that excited universal alarm. Both of these periods were distinguished for severe famine in Egypt, Bengal, and the Carnatic.

Such facts show us the all-powerful influence of the invisible energies of nature, and how little avail human efforts, to avoid the fatal consequences of an universal failure in their operation. That the principles of vegetation do thus fail, at certain times, over large portions of the globe, is an unquestionable truth; it is equally certain, that such events are intimately connected with the cause of pestilence among men. Hence we observe, that men and cattle often perish with epidemic diseases when vegetables fail to yield their customary fruits.

It is not, however, the want of food which occasions diseases so frequently as the bad quality of it. Next to the corrupt state of air, says Riverius, unwholesome aliments are the causes of pestilent diseases. Vegetables may acquire unwholesome qualities from too much or too little moisture, or from other unknown causes. Grain of

of a good quality may alſo degenerate and become unwholeſome by heat and moiſture, after it is gathered, as in magazines, granaries, or holds of ſhips. Such corn may produce diſeaſes in thoſe who feed upon it.

But it is doubtful whether mere want of food ever produced a contagious diſeaſe. Seamen who ſuffer, and even periſh at ſea in a wholeſome air, through mere hunger, pine away and die without diſeaſe. Whenever contagious diſtempers accompany dearth, there is uſually a concurrence of other cauſes to produce the effect.

We may therefore conſider the propoſition of Diemerbroeck as correct, that famine does not produce the plague, but proceeds from the ſame cauſe; yet that ſcarcity of food, and ſtill more certainly, food of a bad quality, may produce diſeaſes of a leſs malignant type, or very much augment, in violence and extent, the current diſorders of a particular ſeaſon.

Yet here again our ſenſes may deceive us. Corn of an apparently bad quality does not always generate diſeaſe. A ſtriking inſtance of this is related in Sinclair's Scotland, vol. vii. p. 605. Froſt, rain, and ſnow, had turned the corn black; it was diſagreeable to the taſte; the ſtraw was equally affected; but neither man nor beaſt ſuffered by feeding on them. So little do we know of the cauſe of diſeaſes.

Inti-

Intimately connected with the ſubject of vegetable nutriment, is the conſideration of diſeaſes among cattle. Whenever graſs is defective in wholeſome nutritious qualities, horſes, horned cattle, and ſheep, are ſure to ſuffer by mortal diſtempers.

It is often mentioned in the foregoing pages, and a fact that every man may have obſerved, that when contagious diſeaſes prevail among men, ſimilar diſorders prevail more or leſs among cattle. Very few of the plagues in ancient Rome affected one ſpecies of animals, without ſhewing the peſtilential principle in others. The ſame remark may be made in all ages, and is true at the preſent period. Sometimes the peſtilence invades one ſpecies of animals firſt, ſometimes another; ſometimes the diſeaſes will be more general and ſevere among men, and ſometimes among cattle: but ſeldom do we obſerve one ſpecies of animals ſeverely affected, and the other totally exempt.

So far as my reading and obſervations enable me to judge, diſeaſes among cattle uſually ſucceed exceſſive or unſeaſonable humidity in the air. The years 1712 and 13, when a plague deſtroyed a vaſt proportion of the cattle in Italy, and great numbers in Germany, are noted in England to have been wet and cold. What was the ſtate of the air in the countries where the diſeaſe was moſt fatal, I am not informed. The ſhort account I have ſeen of it, abridged from

3 Ramazzini,

Ramazzini, in the sixth volume of Baddam's Memoirs, makes no mention of the weather or seasons; and Lancisius, who has also left many particulars respecting it, is not before me. The disease, however, was a true plague, characterized with many of the symptoms of plague in the human body. Authors all agree, that the distemper was propagated solely by contagion from a single cow, from Dalmatia; and they are so well contented with this idea, that they tell us little or nothing from which we can collect the cause. Like the writers on the cause of the plague in Egypt, who trace it to Barbary or Syria, and there leave the subject; so Lancisius and Ramazzini tell us the distemper, which destroyed most of the cattle in Italy, came from one cow, in a drove, from Dalmatia; and there they stop short, without a syllable to explain why the cow from Dalmatia was seized.

All these contagion sticklers resemble the Indian, who, when asked what the world stands on, replied, on an elephant—the elephant on a great turtle, and the turtle, on the ocean.—Here he stopped; and as to what supports the ocean, he leaves us in the dark.

The general visible cause of pestilential diseases among cattle, as before remarked, seems to be an excess of moisture, which renders their food watery and unsubstantial. The summer of 1751, a year of remarkable mortality among the cattle in

in England, was cold and rainy. Such was the ſeaſon in 1348, which was followed by a great loſs of ſheep, as well as by peſtilence among men.

Yet all wet ſeaſons do not produce the ſame effect: and we are conſtrained to reſort, for the cauſe, to unſeen properties in the air, or the food on which the cattle ſubſiſt.—That the ſame general cauſe affects cattle and the human race, in times of peſtilence, is obvious from the analogy of ſymptoms in their diſeaſes. During the preſent ſickly period in America, horſes and horned cattle have died in many parts of the country, with diſeaſes which are characterized with bilious appearances; in analogy with all the diſorders which have affected men, during the ſame period.

Lanciſius and Ramazzini would have treated the ſubject of the diſeaſe among horſes and cattle in Italy, in 1712 and 13, much more like philoſophers and men of ſound ſcience, if, inſtead of telling how much miſchief an infected cow had done, and how the diſeaſe had been ſpread, by farriers, by dogs, and by ſhepherds, they had deſcribed to us the ſeaſons, the ſtate of vegetation, and the diſeaſes which prevailed among mankind. They ought at leaſt to have connected, with the diſeaſe among cattle, an extenſive plague among men, which was then raging in Vienna, Hungary and other countries, as it had been for ſeveral years before, over all the Poliſh and Baltic territories.

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The frequent prevalence of mortal epidemics among the brutes, is an obvious and irresistible proof of some deleterious principle in the elements, which is adequate to the production of the worst diseases, and the destruction of life, independent of every artificial cause.

The brutes, if left to themselves, follow implicitly a principle of their nature, called instinct. They eat what nature intended for them, and never feed on what is pernicious to their health: nor will they injure themselves by eating too much or too little of their ordinary food. Governed by such a law, they can be liable to no diseases, but such as must necessarily proceed from the air they breathe, the water they drink, or the vegetables they eat; all of which are ordinarily good, nutritious, and well fitted to support sound health. Their diseases therefore must proceed from some imperfection in these elements of life, which is occasioned by natural causes. This process of reasoning appears to be strictly logical and correct. The conclusions from it are inevitable. If a state of the elements does ever exist, which can produce diseases that destroy the lives of the brutes, without contagion or any artificial cause, we may safely allege that a state of the elements may exist in any latitude which is adequate to the production of the most formidable maladies that ever affect mankind.

The analogies of the animal œconomy, and continual obſervations, forbid us to ſuppoſe the powers of life in the beaſts of the field, leſs perfect, or more eaſily diſſolved, than thoſe of the human race. On the contrary, from their following their natural undepraved appetites, in the uſe of food and all their actions, their bodies may be ſuppoſed to be more firm and perfect than thoſe of men, who are uſually debilitated by irregularities in living, and other deviations from the laws of nature. If, then, irrational animals are ſubject to the invaſions of mortal epidemic diſeaſes, which mow them down by thouſands, in defiance of the firm texture of their bodies, and their regular living, *a fortiori*, the human race muſt be liable to deſtruction by ſimilar means.

This reaſoning is certainly juſt and ſubſtantial; whatever may be its fate in convincing the reader: and it proves that the natural operation of ſome ſecret principle in the elements, is ſufficient to account for the moſt deſtructive maladies, in every latitude on the globe, without reſorting to the tranſportation of fomites from ſome one heaven-ſcourged country to more favoured regions.

Dr. Mead, and all his ſervile admirers who believe him without inveſtigating his aſſertions, allege that putrefaction never riſes in England to a degree that is neceſſary to generate a peſtilence. But if any man can believe that putrefac-

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tion, as writers are pleased to call the principle of destruction, can rise high enough in the grades of malignity, to produce a plague or contagious mortal distemper among cattle in England, and at the same time never affect the human species, he must have more pride in the super-eminent station of man in the scale of being than I possess. The argument from facts is evidently in favour of the theory, which subjects all animals, in this respect, to the same laws; and the analogies of creation will not authorize man to claim the high privilege of exemption from the general laws of the animal œconomy. It is an unquestionable truth, that men as well as brutes, in all latitudes, are often invaded with contagious and deadly diseases, under the operation of the elements, without the least accession from southern climates, or any foreign country. Multitudes of facts warrant this deduction; but the progression in the violence of epidemic diseases, the imperfection of vegetables, the sickness and death of fish in rivers and the ocean, and of cattle on land, are proofs of the truth of my principle, which bid defiance to opposition.

SECTION XVI.

Of Contagion and Infection.

NO point on the ſubject of diſeaſes has been more agitated among medical writers, than that of the contagion of the plague, inguinal and bilious.

Hippocrates has left no deciſive opinion on this queſtion; but thoſe who maintain the plague not to be contagious, rely on this ſilence of the father of medicine as an argument in their favour.

Galen's opinion was clearly in favour of the contagiouſneſs of certain diſeaſes. "*Quodque periculoſa ſit converſatio cum laborantibus peſtilenti morbo quum nimirum is non ſecus ſit contagioſus, quam ſcabies aut lippitudo.*" * p. 379. The author, doubtleſs, ſpeaks here of other peſtilential diſeaſes, beſides the inguinal plague, according to the practice of the ancients, who gave the name of peſtilence to other malignant diſtempers, when epidemic. His opinion however was, that the plague originates in a putridity of air,

* In another tranſlation, the latter part of this paſſage ſtands thus: "*Periculum enim eſt, ne concipiatur, ut ſcabies, et lippitudo.*"

inhaled by the breath. "*Lues ipſa, ab aëris putredine exorta, per inſpirationes inſiliens, haud unum aut alterum hominem, ſed plures quoque civitates depaſcit, vaſtat, et populatur.*" p. 627. In another paſſage, he remarks, that peſtilent diſeaſes proceed from the atmoſphere. "*Peſtilentes morbi e cœli ſtatu proficiſcuntur.*"

This author obſerved, that peſtilential epidemics muſt have ſome cauſe more powerful and extenſive than contagion or infection.

Ariſtotle was clearly of opinion that the plague is contagious; and the reaſon he aſſigns why peſtilence alone is communicated from perſon to perſon, is, that this is the only diſeaſe which is common to all men. This is not very clear or ſatisfactory; but he ſpeaks of fomites proceeding from the ſick, and infecting others.

See Problem. Sect. i.

Procopius was not a phyſician, but is eſteemed as a hiſtorian. He alleges that in 543 the mortal plague in Conſtantinople was not contagious, and that phyſicians and attendants on the ſick did not contract the diſeaſe.

On the other hand, Thucydides has declared unequivocally, that the plague in Athens was very contagious. Evagrius alſo has related, that the diſeaſe in his time was very contagious to particular perſons, while others eſcaped, even againſt

their inclination. Livy alſo was decidedly in favour of the doctrine of contagion.

Petrus Salius Diverſus, cited by Diemerbroeck, was of the opinion, that the plague is ſometimes contagious; at other times, not. Seneca held to the contagious nature of peſtilence. So ſays Ovid, Metamorph. vii.

> Quo proprior quiſque eſt, ſervitque fidelius ægro,
> In partem lethi citius venit.

The nearer we approach, and the more faithfully we ſerve the diſeaſed, the ſooner we fall victims to the diſtemper.

Thoſe who oppoſe the doctrine of contagion, not only produce as authority the ſilence of Hippocrates, with Avicenna, and other Arabian phyſicians, on the ſubject, but they allege, that if the plague was a contagious diſeaſe, it would *always* infect thoſe who have communication with the diſeaſed. But this they aver to be contrary to fact; and they inſtance the eſcape of many phyſicians, ſurgeons, grave-diggers, hearſemen and others. They argue further, that as the breath and effluvia of perſons in health will not expel the poiſon of the plague from the diſeaſed, ſo, on the other hand, the effluvia from the infected cannot infuſe the ſeeds of the diſorder into a healthy body.

Gregory Nyſſen, a celebrated philoſopher and theologian, concludes, that thoſe who are ſeized with the plague after an intercourſe with the diſeaſed,

difeafed, contract it from the fame ftate of the air which occafioned the diftemper in the fick, and not from the effluvia exhaled from the infected body. While I cannot affent to this opinion in the utmoft latitude, I firmly believe it contains a great deal of truth.

Diemerbroeck, de pefte p. 44, fuggefts that the ancient phyficians, who paffed over the fubject of the contagion of the plague, called that quality only *contagion*, which communicates difeafe by immediate contact, as in cafe of the itch, leprofy, hydrophobia, and the like; whereas the plague infects more frequently through the medium of the air, vapours, garments, and other objects. Thus the fweat, exhalations, and excrementitious matter of the fick, corrupt the air; and this infected air becomes the means of difeafe to perfons in health, who breathe it. This, fays Diemerbroeck, the ancients did not call contagion, proceeding from the difeafed; but they confidered healthy perfons taking the diftemper through this medium as infected by the malignity of the air.

Almoft all modern phyficians, however, agree in the opinion, that the plague is a contagious difeafe, as Foreftus, Profper Alpinus, Diemerbroeck, Sydenham, and a multitude of others; and on this general opinion have been inftituted quarantine laws, and other regulations for preferving cities and countries from the difeafe. Of the value of thefe regulations, we fhall be the better

better able to judge, after taking a careful furvey of the queftion relative to the force and effects of contagion.

Within a few years, one author has ventured again to call in queftion the received opinions on this fubject. Doctor Maclean, in a fmall treatife, has attempted to prove that the plague, dyfentery and epidemic fevers, are never propagated by contagion. Contagion he defines to be a fpecific matter, generated in a perfon affected with difeafe, and capable of communicating that particular difeafe, with or without contact, to another.

This author's general arguments are thefe:—That fpecific contagion muft neceffarily act and communicate a difeafe from a fick to a well perfon, within a certain diftance.—That in the plague, dyfentery, and epidemic fevers, a fmall proportion of people, expofed to the action of the effluvia from the difeafed, are ever affected by the diftempers; and therefore fuch diforders are not contagious. He confiders thofe difeafes only as contagious, which can be received but once by the fame perfon; as the fmall-pox and meafles. He affirms that the exiftence of contagion in plague, dyfentery and fevers, has been uniformly taken for granted, not only without proof, but even contrary to the evidence of numerous and convincing facts. He lays it down as a truth, that all epidemic and peftilential difeafes, which

which may affect a perſon more than once in his life, are cauſed by certain ſtates or viciſſitudes of the atmoſphere, producing indirect debility.

The variety of opinions on this ſubject, argues either a want of accurate obſervations among medical men, or of accurate diſtinctions in terms. The various powers of diſeaſes to communicate themſelves, either have not been underſtood, or they have been imperfectly defined. Let them attend to facts, the only genuine ſource of knowledge.

Firſt. We obſerve that the contagion of the meaſles and ſmall-pox takes effect with great certainty, whenever a perſon in health, who has never been affected, approaches ſufficiently near to a diſeaſed perſon. I do not ſay it *always* takes effect; for there are a few exceptions; but theſe are ſo rare as not to impeach the generality of the fact or principle.

The contagion of the plague, dyſentery and violent fevers, does not, under circumſtances equally favourable, take effect with the like certainty. On the contrary, a great proportion of perſons expoſed to the effluvia of the ſick entirely eſcape the diſtempers.

Secondly. The contagion of ſmall-pox and meaſles is not ſenſibly affected in its operation by heat or cold, moiſture or drought. It acts with the ſame certainty in winter as in ſummer, and in every variety of temperature.

The contagion of plague, dyſentery, and typhus fevers, on the other hand, depends almoſt entirely on heat for its activity, and is ſubdued, rendered inert, or totally extinguiſhed by cold. Hence an eſſential difference in the two ſpecies of contagion—that of the ſmall-pox and meaſles being an eſſential quality of the diſeaſes; while that of the other diſeaſes is an accidental circumſtance.

Thirdly. The contagion of the plague often diſcriminates between the natives of particular countries, or men of a particular blood, or family, ſeizing one and paſſing by another, and this through the whole courſe of an epidemic; but the ſmall-pox and meaſles make no ſuch diſtinctions.

Fourthly. The contagion of the ſmall-pox and meaſles is not deſtroyed by the purity of the atmoſphere; it acts with the ſame certainty on the moſt ſalubrious hills, as in the moſt impure receſſes of poverty.

Not ſo the contagion of the plague and dyſentery; for, as a general rule, theſe diſeaſes are not propagated in a pure atmoſphere. With reſpect to the plague, ſome exceptions exiſt; but it is the uſual fact, that theſe laſt-named diſeaſes will not ſpread by contagion in a wholeſome ſtate of the air. By removing the ſick from a city into the country, or otherways placing him in an airy room, and preſerving it clean, with all the apparel

and

and utensils, the contagion is so dissipated or attenuated, as to be rendered harmless; the attendants escape, and the disease is extinguished with the death or recovery of the patient.

Fifthly. The contagion of the small-pox and measles can never act but once on the same person. Its first operation destroys the capacity of receiving it a second time. The exceptions to this rule are too few to deserve consideration.

Totally different is the effect of the plague and dysentery; for, instead of fortifying the body against a second attack, these diseases debilitate the animal powers, and render the patient more susceptible of the contagion in a subsequent year. It is admitted by all correct observers, that the plague may be received by the same person, times without limits; a person in Constantinople died of the twelfth attack; and many persons in the late plagues in America have been affected two or three times. With respect to dysentery, and other contagious fevers, there is no controversy on this point.

Sixthly. The contagion of the small-pox and measles, if it takes the least effect, produces the disease complete. The infected patient may be affected more lightly than the infecting person; and the degrees of violence in the symptoms may be very various; but the disease produced will always be completely formed, and of the same specific

ſpecific type as that from which it is communicated.

The contagion of the plague and dyſentery has not the ſame certainty in its effect. The contagion of the plague very often produces only a nauſea and vomiting—ſometimes an inferior grade of fever, as an intermitting or remitting fever, of which I have myſelf ſeen examples—very often its effects are limited to dizzineſs in the head, or ſevere pains in the glands; and ſometimes it has produced external eruptions, without any other material affection; as in the celebrated Diemerbroeck, who, in the grievous plague at Nimeguen, was affected with a carbuncle on his left hand, while in good health. In 1796, I ſaw an inſtance in New York, in which the infection of the peſtilential fever had occaſioned a ſingular ſwelling and inflammation in the face of a nurſe, who eſcaped the diſeaſe.

Seventhly. We may perhaps add, what Diemerbroeck and other writers conſider as eſſential to give effect to the contagion of the plague and dyſentery, an apt or ſuitable diſpoſition in the ſound body to receive the contagion. Some peculiar ſtate of a body in health is evidently neceſſary to the operation of the infecting principle of the plague: this is agreed by all authors. But it does not appear that any ſuch ſtate or diſpoſition is requiſite to give effect to the contagion of

of small-pox or measles, which act upon all bodies within the reach of their effluvia. This consideration may be the cause of the first distinction before recited; and a few exceptions exist to the proposition in regard to the small-pox and measles, which, though rarely, fail of operating on bodies in health.

These are the important distinctions, which, had they been observed by medical writers, would have prevented the enormous errors of Mead and others, who maintain that the plague is propagated, in northern countries, by specific contagion only. The truth is, the plague is a contagious disease, like dysentery, and most typhus fevers; but the contagion is *not specific.*

Specific contagion, I define to be, a quality of a disease, which, within a suitable distance, communicates it from a body affected with it, to a sound body, with great certainty, and under all circumstances of season, weather, or situation. Such is the contagion of the small-pox and measles. This contagion is of two kinds; first, that which acts by contact only, as that of the itch, leprosy, hydrophobia and syphilis; secondly, that which produces its effect, with equal certainty, by near approach; as that of small-pox and measles. The contagion of the angina maligna approaches to the specific kind; and if it is true, as some modern physicians have asserted, that persons can never be affected with it more than

than once, it comes under the character of *specific* contagion; but I doubt the fact.

That quality of the disease which may or may not excite it in a sound body, within a suitable distance, or by contact; and which depends on heat, foul air, an apt disposition in the receiving body, or other contingent circumstances, and which may excite the disease in the same person more than once, is certainly a very distinct species of contagion from that of the small-pox; and to this I give the denomination of *infection*.

With a distinction of this sort, which seems to have been first adopted by an eminent physician in New York, Doctor Baily, in his treatise on the fever of 1795, page 38, and which is unquestionably well founded, we have no difficulty in explaining all the phenomena of contagion, which have given rise to disputes without number, and to the most contradictory opinions. The plague, glandular and bilious, the dysentery, typhus fevers, and the milder kinds of angina, are not *specifically contagious*; but they are *infectious*. They will not, and do not, propagate themselves in all situations; but the operation of the infecting quality is controlled by a multitude of contingent circumstances.

First. It is admitted on all hands, that a suitable and particular constitution of air is necessary to render the plague epidemic in northern latitudes. Thus Sydenham supposes this disease

to

to be conveyed by peſtilential particles from one place to another, but not to become epidemic, unleſs favoured by the conſtitution of air. One ground of his opinion ſeems to have been a fact related by Mead, that when the diſeaſe has raged violently in one town, in the ſame climate, a neighbouring town has totally eſcaped, by forbidding intercourſe with the infected place, as once happened in Tuſcany.—This fact will be afterwards conſidered.

Mead alſo, while he declares his opinion, that the plague is ſpread by ſpecific contagion only, like ſmall-pox and meaſles, and that all plagues are to be traced to Egypt, very inconſiſtently admits that a certain corruption of the air is neceſſary to give the contagious atoms their full force.

Theſe opinions are utterly incongruous; for if the plague poſſeſſes ſpecific contagion, like the ſmall-pox, then a corrupt ſtate of air is *not* neceſſary to give full force to the contagion; for no ſuch ſtate of air is requiſite to give force to the contagion of the ſmall-pox. It ſpreads with as much certainty in pure air as in foul air. Mead's principles therefore overthrow his own theory. But he was driven to admit ſome general conſtitution of air to be neceſſary to the propagation of the plague, becauſe he had learnt, from reading, that the plague will not ſpread in all places, at all times, and under all circumſtances. In truth, Mead

Mead never had an idea of the difference between the ſpecies of contagion; and the ſame may be ſaid of moſt modern writers.

It is a moſt extraordinary circumſtance, that the Britiſh authors, in modern days, ſhould all agree that a favourable conſtitution of air is neceſſary to propagate the plague, and yet that no plague is bred in northern climates. They muſt and do admit, that ſuch a favourable ſtate of air has often exiſted in all parts of Europe: this is a kind of half-way buſineſs; allowing northern climates the power of creating and preparing a condition of atmoſphere that ſhall meet the plague half-way.

But will it be denied that the petechial fever and angina maligna originate in northern latitudes? I preſume not. Then the condition of air is admitted to produce *moſt deadly infectious* diſeaſes, but not *the moſt deadly of all.* Kind heaven, in mercy to the northern world, has permitted the elements to generate diſeaſes almoſt as bad as the plague, but not quite.

I then aſk, does not the production of the angina maligna ſuppoſe as deleterious a principle in the air as that of the plague? Is not the diſeaſe as fatal to youth, and more certainly infectious or contagious? This cannot be denied. That diſeaſe deſtroys as great a proportion of patients ſeized as the plague, and is more certainly contagious to youth. Beſides, this diſtemper depends

depends not on local caufes, but wholly on a condition of the elements. It therefore implies a moft effential alteration in the atmofphere.

Further, if petechial fever is generated in northern climates, it demonftrates the power of thofe climates to produce the plague; for it has been proved that this fever is the fame fpecies of difeafe, and often turns to the plague. It has done this very often in England and on the Baltic.

Infection fpreads certain difeafes, and ought to be avoided; but medical men have afcribed ten times more effects to that caufe than it ever produced. The fame principle which generates the angina maligna, or plague in one inftance, muft be competent to produce it in all other perfons of like difpofition and habits.

Sanctorius, cited by Van Swieten, remarked that the rays of the plague may be removed by the wind; yet he was furprized to obferve, that thefe rays from the body of a difeafed perfon, are never difturbed by the force of the air. I do not perfectly reconcile thefe remarks; but it is an indubitable fact, that a peftilential ftate of air, when clearly and diftinctly formed in a city, is not diffipated, nor very greatly affected by the moft violent winds. It has fometimes been remarked, that the peftilential fever in American cities has been fpread by particular winds; but it has fpread

not only before but against the wind, though perhaps with less rapidity. Certain it is, that no force of wind whatever ever expels from a town, or lessens the pestilential virus, without the aid of other causes. Of this we have had repeated proofs in America.

Perhaps we may explain this fact, and reconcile the observations of Sanctorius on the principle I have unfolded, by supposing the effluvia of the sick to be in some degree capable of dissipation by the wind, which is undoubtely true; but that the elemental cause of pestilence, which consists in the essential properties of the atmosphere, is not subject to dissipation or removal by the winds. This consideration would involve a curious question, viz. whether, in the apparent motion of air called wind, the whole mass of the surrounding atmosphere is moved? or whether it is the vapour or other component parts of the air only which are moved, while the fire or electric fluid remains stationary? But whatever may be the cause, the fact is certain, that the pestilential principle during a plague in a city or town, is never expelled by winds. A most violent cool North West wind swept the city of New York on the 19th and 20th September 1795, without any considerable abatement of the pestilential fever. This fact adds no small weight to my opinion, that the primary cause of such diseases is in the essential

essential combination of the component parts of the atmosphere *.

Sanctorius further observes, that " things infected with the plague communicate the disease as long as the proximate and remote causes subsist, one of which ceasing, the infection ceases." This is an explicit acknowledgment that the contagion is not *specific*, but dependant on some other cause, agreeable to the doctrine of Sydenham.

This principle is verified most remarkably in Egypt, as appears by all the authors who have written on the subject. They are all constrained to admit, even when they allege the plague to be not native in that country, that if imported at certain seasons of the year, it will not spread. Prosper Alpinus expressly declares, that the plague is *never imported in the months of June, July and August*; " *nunquam visa est pestis illuc ex infectis*

* Warm southerly rains, however high the wind, usually increase the violence of the disease by inducing debility and giving activity to the local causes, as noxious effluvia from vegetable substances. Cool northerly winds, *accompanied with heavy rains*, lessen the morbid action of the pestilential principle; and if late in the season, and not succeeded by very warm weather, may entirely remove it. A violent tornado, with great rain on the 8th of October, 1797, was supposed to put a stop to the pestilential fever in Providence. Water decomposes the poison, or incorporates it into its own mass; but *heat* after moisture occasions a more rapid decomposition of vegetables, and increases the poison.

 locis

locis profecta;" although he maintains that the diſeaſe is almoſt always imported.

This is certainly a moſt extraordinary aſſertion, and unworthy of the reputation of the writer. What in the name of ſenſe and conſiſtency ſhould prevent the ſeeds of ſuch a diſeaſe from being "imported" in a particular ſeaſon, when veſſels are paſſing continually between that country and infected places? The idea betrays extreme weakneſs or prejudice.

Savary, in his letters on Egypt, has detailed the true ſtate of facts. He ſaw veſſels which arrived in Egypt from Turkey in the month of Auguſt, and landed their infected goods and people without communicating the diſeaſe. He informs us, that it is an obſervation of ages, that infected merchandize brought into Egypt in the months of June, July, and Auguſt, do not excite the plague but the diſeaſe expires of itſelf. If introduced at other ſeaſons and communicated, it ceaſes; but if imported in winter, it ſpreads.

The author has here ſtated effects or phenomena with a good degree of accuracy; but has entirely miſtaken the cauſe. It is wholly the ſtate of air in different ſeaſons, and not infection which occaſions theſe varieties.

Mackenzie, in an account of the plague in Conſtantinople, though a firm believer in its contagion, declares "that both in that city and in Smyrna, the plague breaks out in ſome years when

when it is not poſſible to trace whence it is conveyed." This is doubtleſs true; yet neither this fact, nor the known fact, that contagion in Egypt will not operate in a certain ſeaſon of the year, has ever opened the eyes of European authors to the abſurdity of the current notions about the ſpecific contagion of the diſeaſe.

A fact related by Patrick Ruſſel in his hiſtory of the plague at Aleppo in 1760, is full to the ſame point, that the contagion of the plague will not take effect without the aid of other cauſes. In 1759 the diſeaſe was introduced into Limſol, a port on the South ſide of Cyprus, where it ſpread. Larnica, a town forty miles diſtant, received part of the infected crew which brought the contagion to Limſol. A conſtant communication was held between the two cities; peaſants and mule drivers entered Larnica with their peſtilential ſores upon them, and were daily in the ſtreets and markets. Some died in houſes of the inhabitants. Other veſſels alſo arrived with infected crews from Egypt, ſome of whom died on landing. Yet mark the iſſue—all this contagion did not excite the plague in Larnica. But in the beginning of the next year, eight months after, the diſeaſe appeared in Larnica without contagion, and made great havoc.

See Ruſſel, page 4.

This fact and others compelled the author to admit that the diſeaſe is not always contagious, and that it does not become epidemic without a certain ſtate of air. See pages 4, 5, 7, 17, 19, 307. Theſe facts are of infinite conſequence in directing the application of laws of quarantine; a ſubject to be hereafter diſcuſſed.

Innumerable examples may be produced of plague appearing in a few detached caſes without becoming epidemic, and without extending itſelf by contagion beyond a ſingle family. Often it appears in ſporadic caſes without exhibiting any contagion.

Fallinus relates an inſtance of a family in which the father, mother, with two children and a ſervant, died of the plague without glandular ſwellings, and without ſpreading the diſeaſe beyond that family.

Joubert informs us of an inſtance in 1574, of which a reſpectable family which loſt half of its members by the plague, which ceaſed without ſpreading the infection. This was at the commencement of a moſt peſtilential period.

Matthias Untzerus relates, that at Halle in Saxony he was an eye witneſs of inſtances in which here and there a family had been ſeized with the plague, introduced from other places, without any ill-effects in the reſt of the city; the diſeaſe terminating in thoſe families.

Diem-

Diemerbroeck obſerved ſimilar facts. In October 1661, the daughter of a noble widow was ſeized with a violent diſeaſe reſembling the plague in the midſt of a town where no plague exiſted, and no foreign cauſe could be aſſigned for the diſeaſe. The ſervant who attended her died, and the infection extended to ſeven perſons in ſucceſſion; the reſt ſaved themſelves by flight. Theſe perſons died without the glandular tumours, and of courſe ſome of the attending phyſicians denied the diſeaſe to be the plague. Diemerbroeck, on the contrary, judging from all the ſymptoms, pronounced it the plague. It happened that one of the maid ſervants who left the family, and was going to her brothers at Amſterdam, was infected and ſeized with the plague, which ſoon put on the genuine marks of the diſeaſe in an inguinal tumour and two anthraces. She recovered, but infected two of her brother's children, and there the diſeaſe diſappeared. No local cauſe could be aſſigned for the diſeaſe in that family. The plague was not before in the city or country; the houſe was a ſplendid, elegant one, and kept remarkably clean, remote from any filthy place, and had never been known to have an infected perſon in it. Hence our author concludes very juſtly, that a peſtilential diſeaſe is not always epidemic, nor is any epidemic always dangerous; nor is peſtilence neceſſarily common to many people; but that the

ſpreading of a diſeaſe by contagion is wholly an accidental circumſtance.

See page 13, 14, of Diemerbroeck, *De Peſte*.

On this laſt fact I will only obſerve, that the year it happened was 1661, the beginning of the conſtitution which produced the augmented violence of the diſeaſes of London, as related by Sydenham, and the conſtitution which occaſioned the plague in Holland in 1663 and 4, and that in London in 1665. It is to be regretted, that thoſe able phyſicians and accurate obſervers had not extended their views of the ſubject to a prevalence of that peſtilential conſtitution in various countries at one and the ſame time, inſtead of reſtricting their obſervations each to his own country.

The author of the *Traité de la peſte*, who was a warm ſtickler for the origin of the plague at Marſeilles in 1720 from importation, and wrote a treatiſe to prove it, has however demonſtrated the contrary. He has admitted that the air of Marſeilles was peſtilential, and produced diſeaſes marked with buboes and carbuncles in the autumn preceding its ſuppoſed importation. But this is not all; he has recorded facts which confirm all that has been cited from Alpinus, Savary, Ruſſel and others, that the contagion of the plague will not ſpread the diſeaſe in an atmoſphere not favourable to its propagation. He informs us, that

that the diſeaſe ſpread from Marſeilles in ſpite of all precautions, and infected more than fifty villages of Provence. This was aſcribed to infected goods conveyed from Marſeilles. Yet the ſurrounding provinces of Languedoc, Valais, Dauphiné and others, which he acknowledges to have been inundated with goods from the ſame city, eſcaped all infection. In Provence the diſtemper reached the inhabitants of mountains, and was not even arreſted by the rigours of winter; while, in the adjoining territories, no perſon was affected, though equally expoſed to infection. The author remarks further, that the diſeaſe paſſed over ſome villages, and infected others beyond them; for which no reaſon could be aſſigned, while all were alike expoſed.

Theſe facts were very ſurpriſing and unaccountable to the author, Chicoyneau; yet there is no difficulty in explaining them on the principle for which I contend; that the propagation of the diſeaſe depends entirely on the favourable ſtate of the atmoſphere, and not the leaſt on contagion.

Almoſt all the ſuppoſed inſtances of infection from merchandize, related in authors, when inveſtigated, are found to be mere ſuppoſitions and conjectures, raiſed and ſpread by vulgar credulity without the leaſt foundation; and afterwards recorded as facts by medical writers, who are infinitely leſs excuſable than other people. I have inveſtigated many ſuch inſtances in America,

where reports had become popular, and grown into ſuch credit as to be generally believed and received as facts; and I have, in every caſe, found evidence amounting to demonſtration, that theſe reports were idle ſurmizes, very often puerile in their origin, and utterly unſupported by facts. Some of the received opinions, in regard to the imported infection of plagues in Europe, when ſubjected to careful ſcrutiny, prove to be equally deſtitute of foundation. Among theſe are the opinions received and recorded by grave writers, relative to the London plague of 1665, and that at Marſeilles in 1720.

The ſuppoſition that the plague was conveyed from Marſeilles into fifty villages of Provence by means of merchandize, appears to be no better founded. Setting aſide the errors of vulgar tales in which ſuch opinions uſually originate, it is utterly againſt all probability, that goods ſold from ſhops and warehouſes ſhould contain infection. If they are ever infected, it muſt be by being uſed by the ſick; but the ſick do not uſe the goods in ſhops and ſtores; they are confined to their rooms; and rarely indeed are their bedding clothes ſent to market. Goods, the moſt ſuſceptible of infection, as woollen and cotton, may lie in a ſtore during the plague without any taint that can excite diſeaſe. In America we know this to be fact. In every town where the fever has prevailed, ſhops and warehouſes filled with

with ſuch ſort of goods are open long after the diſeaſe has appeared, and until the air of the ſtreets has become ſo peſtilential as to excite the diſeaſe in a few hours in healthy ſtrangers; nay, ſome of theſe ſhops are open during the whole time of the rage of our worſt plagues; yet even cotton and woollen cloths have never, in any inſtance, contracted infection, ſo as to communicate the diſeaſe afterwards to thoſe who handled or uſed them. I will venture to aver that all the reports in Europe about the propagation of the plague from town to town, and country to country by merchandize, are the offspring of vulgar tales. It is poſſible that garments *worn by the ſick, and not cleanſed*, may excite the diſeaſe in a ſound body; but ſuch garments, to retain the infection, muſt be cloſely packed in bales, cheſts, or boxes, or the action of the air will deſtroy the infection in a few days. And whenever an inſtance of this kind happens, the diſeaſe will die with the patient firſt infected. It will rarely or never ſpread, unleſs the conſtitution of air is ſo peſtilential as to produce the diſeaſe without infection.

In theſe poſitions I am warranted by a multitude of facts related of European plagues, and many that have occurred in America.

Hence goods tranſported from Marſeilles during the plague, did not communicate the diſeaſes in Languedoc, Valais, or Dauphiné. The true

true reaſon of the facts related by Chicoyneau, is, that the air of the whole country about Marſeilles was peſtilential, and affected moſt of the villages of Provence, although ſome eſcaped. Further removed from the ſea ſhore in the contiguous provinces, the air was leſs peſtilential, and the diſeaſe did not appear. Goods were conveyed to all theſe provinces indiſcriminately; but they had no concern in the propagation of the plague. The plague appeared, where the peſtilential principle was competent to produce it, the ſeat of which was at Marſeilles, a large populous city; but which extended, as it always does, to ſome diſtance, beyond which it produced no plague. Wherever the diſtemper appeared, vulgar ignorance aſcribed it to goods; and where it did not appear after the reception of goods from Marſeilles, the vulgar and the learned all agreed they could not account for it; they wondered that goods would not infect people in Languedoc as well as in Provence; and all the writers on the ſubject in Europe, from that time to this, ſeemed to have been ſatisfied with wondering at the phenomenon.

Of the truth of the doctrine that the plague will not ſpread from infection in an atmoſphere not proper for it, we have in America moſt indubitable evidences.

In every peſtilence that has affected our cities for ſix years paſt, great numbers of perſons, when

when ill, have been removed into the country, or have been ſeized after removal; but not one inſtance occurred of the ſpreading of the diſeaſe in the country, to any extent, from ſuch infected perſons, until the year 1798. There have been a few ſcattering inſtances, in which the nurſes of ſuch perſons have received the diſorder. Theſe have been very rare; probably not in one inſtance of a hundred, has any perſon been affected by fomities from ſuch diſeaſed perſons. Moſt violent caſes of the peſtilence, when removed into a pure air, exhibit no infection that is perceptible. This fact correſponds with what has been related of the importation of infected perſons and goods into Egypt in June, July, and Auguſt, which produces no ill effect; but for a very good reaſon; the air of that country, during the inundation of the Nile, will not *generate* the plague; and hence the vulgar idea, that it is not imported, or will not ſpread from infection.

But not only do our country people eſcape infection from diſeaſed citizens, who ſicken and die in their houſes, but our cities alſo, when the conſtitution of air does not favour the diſeaſe, are not affected by the introduction of the worſt caſes from neighbouring cities. Thus in 1793, many perſons from Philadelphia entered New York, in ſpite of precautions taken by the police, ſickened and died in boarding-houſes, and other places, but without communicating the diſeaſe in a

ſingle

ſingle inſtance. In 1795, the caſe was reverſed; New York generated a contagious fever, but Philadelphia did not; and ſeveral perſons who left New York, ſickened and died in Philadelphia without infecting any perſon whatever.

It is unneceſſary to multiply examples; the ſame has happened between Philadelphia and Baltimore; between Norfolk and the adjacent country; between Boſton and Providence; in ſhort, there is not an exception to the remark, that infected perſons, carried into towns and cities when the atmoſphere has not been diſpoſed to generate an epidemic, have never propagated the diſeaſe. In every caſe, and the inſtances have been very numerous, the diſeaſe has diſappeared with the recovery or death of the firſt or ſecond patient *.

But this is not all. In the ſame town or city, when the peſtilence has been general in a particular quarter, another part of the town or city, ſituated on better ventilated or more elevated land, has not only been free from the epidemic, but has poſſeſſed an air capable of reſiſting the

* In 1798, the firſt caſes of the fever in Cheſter and Wilmington, originated from Philadelphia; but the atmoſphere alſo of the country in New Jerſey and Delaware, actually *generated* the diſeaſe in the neighbouring diſtricts, and ſo it did in Connecticut.

infec-

infection of the diseased. This, to a certain degree, was the fact in Philadelphia, where no part of the city can be called elevated; yet in 1793, and 1797, few cases of the fever occurred in the western part of the city. But in New York, New Haven, Providence, New London, Boston, and Newbury Port, the disease has had its pestilential region, or quarter of the town, in which it became epidemic and infectious; but other parts of the town have been free from it. And in all such instances, the most malignant cases in persons seized in the pestilential region, and conveyed to the healthy part of the town, have exhibited no infection; or if a single nurse has taken the disease, of which I have heard of two or three instances, the infection has there ceased, and produced no further effects.

These exempted parts of the towns are the more cleanly and airy situations. To this, however, occur two exceptions. One in Philadelphia, in 1798, the disease of which year was more virulent and more infectious, than in former years, and extended to healthy positions. The other exception is in New-London, the last summer also; in which town the disease had indeed its pestilential region marked distinctly, as before related; but this part of the town where the disease raged, is as airy and well built as any other quarter.

Evagrius

Evagrius remarked of the plague in his time, that it ſometimes attacked certain parts of cities, and left others untouched.

See the year 590.

Peſtilential diſeaſes then have an atmoſphere in which they rage with violence; but at a diſtance they loſe the power of infecting, at leaſt to a great degree. Van Swieten remarks this of the ſpotted fever in 1756—if healthy perſons deſcended into the valleys where it was prevalent, they took the diſeaſe; but when removed into more airy ſituations, they infected no one.

Vol. xvi. page 59.

Theſe facts all concur to eſtabliſh the principle, that ſome other cauſe muſt act with infection, to render this peſtilence epidemic, or to give it effect. The conſequence is unavoidable, that the infecting cauſe is *not a ſpecific contagion.*

In the ſecond place, the infecting power of the plague, and other autumnal diſeaſes, is ſuſceptible of gradation from the loweſt point of danger, up to the higheſt; a circumſtance that does not characterize the ſpecific contagion of ſmall-pox and meaſles. In America, we have ſeen the diſeaſe in every ſtage of virulence, except, perhaps, the very higheſt; like that in the days of Gallus and Voluſius; that in the time of Evagrius; or that

that in the reign of Edward III. and a few others. The diſeaſe in Philadelphia, in 1797, was more infectious than that in 1793; and that in 1798, ſtill more than either. The fever in New York, in 1795, exhibited very little infection, not one caſe in twenty proceeding from any communication with the ſick; but in 1798, the diſeaſe put on a more virulent aſpect, and was more generally infectious. In Baltimore, the diſeaſe in 1797 ran through all the grades of bilious fever, from an ordinary remittent, which for weeks prevailed without infection, to a contagious yellow fever.

But this is not all. During the ſame ſeaſon, in the ſame city, the diſeaſe exiſts in all its grades, from an intermittent to the contagious yellow fever. It is a very frequent thing for perſons ſeized with decided ſymptoms of the peſtilential fever, to have the diſeaſe reduced by early applications to a remittent, or intermittent. Of this I am an inſtance myſelf; having contracted the malignant fever in New York, in Auguſt 1798, from the air of the city, for I was near no diſeaſed perſon, and returned home, I was ſeized with the ſymptoms, though not of the moſt violent kind. The fever was diſturbed by early remedies, and I became convaleſcent, but in a few days I relapſed, and the fever took the form of a regular tertian. Dr. Ruſh relates ſimilar examples in the fever of 1793.

Lind, on diseases of hot climates, p. 179, remarks, that patients, with a mild intermittent, sent to Greenwich Hospital, near a marsh, in Jamaica, soon grew worse, and their disease turned to a malignant yellow fever, or mortal dysentery.

A multitude of such facts have been observed in America, which, with the remarkable history of the disease in Baltimore, in 1797, seem to amount to a demonstration, that the plague and all autumnal bilious disorders, are of one species, differing only in their grades. Indeed the writers on the Levant plague, while they utterly deny such a sameness in kind between that disease and any other, have recorded facts to prove the doctrine here maintained.

Patrick Russel admits, that the plague in Aleppo was of very various degrees of malignity, and was not always infectious. He has even arranged the cases in several distinct classes, according to the various symptoms and degrees of mortality.

Lady W. Montague, in letter thirty-one, has the following observations: " Those dreadful stories you have heard of the plague, have very little foundation in truth. I own I have much ado to reconcile myself to the sound of a word which has always given me such terrible ideas; though I am convinced there is little more in it than in a fever." She then proceeds to relate, how

how ſhe paſſed through ſeveral infected towns, that her cook was taken ill, and ſhe was told, with a cold—that ſhe left her doctor to attend him, but the cook ſoon recovered; and both cook and doctor, in a few days, arrived in health at Adrianople. She was there ſurprized to learn, that her cook had been ill with the plague. She concludes from her own experience, that the air is never infected, and that it is as eaſy to root the plague out of Turkey, as out of Italy and France*. She remarks alſo, that "many eſcape it"—which is certainly wonderful!

Juſt ſo careleſsly people reaſon and draw conclusions from a ſingle curſory obſervation, or an iſolated fact; a practice among travellers, as among men of pretended ſcience, which is the ſource of numberleſs errors. It is undoubtedly true, that the plague is often "little more than a fever;" but if Lady Montague had been in Cairo in 1580, or in 1736; or in Conſtantinople in 543, or in 1751; or in London in 1665; or in Marſeilles in 1720, ſhe would have thought the plague ſomething more than an ordinary fever. The truth is, the diſeaſe exhibits different grades of violence at different times.

* Notwithſtanding this diſeaſe was "rooted out of France," it happened that, in two years after Lady W. Montague wrote her letter, Marſeilles was almoſt depopulated by the diſeaſe!

Savary remarks, that ſuch as *catch* the plague in Egypt in June, July, and Auguſt, are always cured.

So obſerves Mignot, in his Hiſtory of the Turkiſh Empire, vol. ii. p. 4. "The plague, at certain times, is incurable; at others, eaſy to be cured. The contagion is more or leſs ſtrong, according to the ſtate of the air."

Similar remarks occur in the *Traité de la peſte*. The author is full of his idea of the contagion, but he ſays, the plague, though always from one cauſe, appears differently in different places, and a ſmall diſtance between them makes it appear like two different diſeaſes, as at Montpelier and at Lyons.

Chandler, in his travels, gives us wonderful diſcoveries on this ſubject. He ſays, the diſeaſe proceeds from certain inviſible animalcules burrowing and forming their neſts in the human body. Theſe are imported annually into Smyrna —they are the leaſt fatal at the beginning and latter end of the ſeaſon. If they arrive early in the ſpring, they are weak, but gather ſtrength, multiply, and then periſh!!

Such ſilly opinions are gravely recorded in books, yet they prove that infection is of very different degrees of ſtrength, or that it is the ſtate of the air, and not infection, which produces the diſeaſe.

P. Alpinus, followed by Volney, Savary, and others, ſpeaks of this difference in the malignity

nity of the plague; but he aſcribes it to the *place* where the diſeaſe originates. He ſays, the contagion from Barbary is more putrid and virulent, than from Greece and Syria, and inſtances that of 1580, vol. iii. p. 61 and 2.

It is true that ſome of the moſt violent plagues have firſt appeared in Ethiopia and Barbary, as in the time of Thucydides, in 252, in 1580, in 1736; but theſe writers ought to have recollected that others equally violent have originated in Egypt, in China, in Italy, and in Conſtantinople. Witneſs that in 542, which began near Peluſium, in Lower Egypt; thoſe of 1347, and of 1450, which began in China, or other parts of Aſia, and that of 745, which commenced in Calabria, in the kingdom of Naples.—They might have obſerved alſo, that many plagues, of the moſt deſtructive kind, have appeared at once in twenty or more cities of Europe. Theſe conſiderations would have detected the puerility of the notion, that contagion from one country is more "putrid and virulent" than from another, and led the obſervers of nature to the true cauſe of theſe different grades of malignancy, different ſtates of the atmoſphere in different periods.

Fernelius divides epidemics into three kinds: an epidemy from exhalations or vapour from the earth; from great changes of ſeaſons; and from an occult malignant quality in the air; the laſt, he maintains, is the only true cauſe of the peſtis;

the others are preparatory to it; but these causes often unite, and the plague then becomes most severe. Putrid exhalations do not alone produce the plague, but prepare for it and aid its progress. Hence it does not affect all places or all men alike—but is most severe in maritime places, in those exposed to the south, warm and humid, abounding with impure exalations.

De Morb. Pest. 189.

There is a great deal of truth in these observations, and I cannot but remark how much more correct those authors are, who often saw the plague, than Mead and others who had no such advantages.

The violence of the pestilential principle, aided by seasons remarkably debilitating, has sometimes dispatched the human race with terrible rapidity. The more usual course of the plague is from five to seven days, when death, or a favourable crisis, takes place. But to this there have been some dismal exceptions. The disease described by Evagrius, in 590, generally put an end to life in three days. This also was the period of the crisis in the dreadful plague, in the days of Vortigern, in 448, and the subsequent years. In the similar calamity of 1348, few patients lived beyond the third day.

In many instances, during these more general plagues, persons have died suddenly, as in an apoplexy;

apoplexy; as in the peſtilence at Narbonne, in 1534, where men frequently fell dead as they were walking or converſing; of which Stenkius himſelf was often an eye witneſs. He cites as authorities for the ſame fact, Valleriola, Gemma, Salius, and Cardanus. See page 765.—The ſame happened in the peſtilence deſcribed by Evagrius; and authors relate that no leſs than eighty perſons fell dead, in a proceſſion, inſtituted by St. Gregory, about the year 590 *.

Dion Caſſius mentions an expedition of a Roman army into Arabia-Felix, in which moſt of the ſoldiers periſhed by unuſual diſtempers. Many of them were ſeized in the head; the brain diſſolved, and the diſeaſe falling upon the throat, ſuffocation ſpeedily ended life.—This was evidently the effect of extreme heat, producing exceſſive excitement, and ſoon followed by a total debility of the nervous ſyſtem.

Terrible indeed muſt be that virulence of the peſtilential principle, which bids defiance to cold. Yet ſuch has been the caſe in a number of plagues. In the peſtilence of 543, ſays Procopius, the diſeaſe invaded ſome places in ſummer, others in winter. Evagrius makes the ſame remark of the

* This diſeaſe ſometimes attacks in the form of an apoplexy; in other caſes, perſons are indiſpoſed for ſome days, but able to walk, while the diſeaſe is ſecretly undermining the animal powers. Such perſons ſuddenly paſs from apparent health to their graves.

plague in 590. The black peſtilence of 1348 attacked countries, in northern latitudes, in winter or ſummer, without diſcrimination. The diſeaſe in Provence, in 1720, was not controlled by the rigours of winter. The peſtilence in 1591 raged through a cold winter, in Revel and Narva, in the 59th degree of North latitude. "Sometimes, ſays Fernelius, the moſt intolerable heat of ſummer produces no peſtilential diſorder; at others, the plague breaks out in winter, and ceaſes in the midſt of ſummer, or in autumn."

Page 189.

Diemerbroeck remarks, that a plague which begins in winter, or autumn, is more violent, and of longer duration, than one which begins in other ſeaſons. So ſays Peter Paſchal, an author cited by Diemerbroeck; the plague which begins in ſpring or ſummer, ends in winter; that which begins in autumn, or winter, is of longer continuance.

The reaſon of this diverſity is very obvious. The peſtilence which appears in winter, in northern latitudes, can proceed only from a diſpoſition of the atmoſphere; for cold totally deſtroys all infection of that diſeaſe, and all the influence of putrid exhalations. Whenever therefore the plague invades man in cold weather, it demonſtrates a *more malignant* ſtate of the air, and one that is not controlled by cold weather or froſt. Such a

ſtate

ſtate of the air muſt of courſe produce more fatal effects, than an inferior force in the peſtilential principle, which perhaps requires the aid of heat, humidity, and noxious exhalations, to produce a very violent plague. Thanks to heaven! moſt of the peſtilences that afflict mankind are of this latter or ſubordinate degree; in which the real plague is limited to places highly charged with morbid ſubſtances, which it is in the power of man to diſſipate or remove.—A vaſt proportion of all peſtilential diſeaſes are found to rage only in cities, jails, camps, and crouded ſhips, and may be avoided or mitigated by human means.

At the ſame time, hiſtorical facts warrant me in believing that the peſtilential principle does, at times, acquire a virulence that proves fatal to life, in every ſeaſon and every ſituation; aſſailing, indiſcriminately, the city and the cottage; the cleanly dwellings of the rich, and the filthy cells of the poor; the higheſt hills, as well as the vallies; the borders of moraſſes, and the nauſeous allies of a populous town. During this melancholy ſtate of the elements of life, and ſuch was their condition during the ravages of the black peſtilence in the reign of Edward III. men are, however, not to deſpair of preſerving life; but the means conſiſt in applications to the human body, calculated to guard, not againſt infection ſo much as againſt *debility*, the deciding proximate cauſe of the malady.

Hiſtorians

Historians mention a remarkable difference in the operation of the two very furious plagues in 1348 and 1361. That of 1348 was most fatal to the poor; but that of 1361 was most mortal among the nobility and gentry, and on hills and mountains, which usually escape. In the first place then, morbid exhalations constituted an influential cause in propagating the malady—in the latter case, they operated as a shield or antisceptic—and the facts demonstrate the various force of the elemental causes.

In the third place, to give effect to the infection of the plague, and at times to other autumnal diseases, there must be an apt or suitable disposition in the human body. This is admitted by Hippocrates, who observes, that body differs from body; the nature of one man, from that of another; the nutriment of one, from that of another; and the same things are not alike pernicious to one species of animals, as to another. Hence he accounts for diseases invading one kind of animals at one time, another species at a different time, and different species having their various distempers.

Lib. de Flatibus.

Thus Galen remarks, that the same causes do not affect all persons alike; if they did, violent heat, excessive fatigue, or drinking, or anger, or grief, would produce fever in every person; and

for the same reason, all persons alike would be seized with pestilence during the reign of the dog star.

De di. feb. cap. iv.

In conformity to these ideas, Diemerbroeck, p. 50, lays it down as a principle, that no person will receive infection, unless his body has an *aptitudinem*, a fitness or disposition to receive it, arising from some secret quality or bad state of the system.

On this point, we reason without knowing causes; all we can do is to collect and arrange facts, which decide in favour of this hypothesis. We are compelled to admit the principle, not only as it respects the operation of infection, but also of the elemental or primary atmospheric cause of pestilence, which makes an evident distinction, at times, between persons of different habits, families, and nations *.

These facts come under the observation of Procopius and Evagrius. In 543, says the former,

* Medical men are not agreed as to the nature of what is called *predisposition*. Brown, in Elements of Medicine, defines it to be a less degree of the disease; that is, the commencement of the disease. I suspect this definition, properly limited, to be nearly just. It is probable that all fevers are the effects of debility, and that when this debility commences, a person may be said to be *predisposed to disease*; although the disease may not be formed in many days or weeks after, or may be prevented by early applications.

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no phyſician or attendant caught the diſtemper—while many were ſeized, they knew not from what cauſe, and ſuddenly died. Many, ſays Evagrius, who fled from infected places, remained ſafe themſelves, while they communicated the diſeaſe to others. Many who remained with the ſick, and freely handled them, wholly eſcaped. Others, in deſpair for the loſs of friends, threw themſelves in the way of infection, but were not able to contract the diſeaſe; while others received the diſeaſe by the ſlighteſt connection with infected houſes, or in open market.

We have many memorable examples of a ſimilar nature in America—they are too numerous to be ſpecified. I ſuſpect, however, that four-fifths of ſuch caſes are improperly aſcribed to infection.

Diemerbroeck relates, that in the height of the plague at Nimeguen, the air was ſo bad, that all places were nearly alike, as to the danger of infection; perſons received the diſeaſe with or without intercourſe with the ſick.

Sometimes the plague diſcriminates between natives of different countries. The French fugitives from the Weſt Indies, who have reſided in our cities during peſtilence, have generally eſcaped. This is not, however, very remarkable, as they are accuſtomed to a climate which is, like our ſummers, peculiarly fitted to produce a ſimilar diſeaſe; at the ſame time, their manner of living

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is better ſuited to the warn ſeaſon, than that of our own citizens.

But a ſimilar diſcrimination has been often obſerved, among natives of the ſame latitudes, or nearly the ſame. Thus Cardanus, Lib. viii. relates, that in a peſtilence at Baſle, the Swiſs only were affected; the French, Italians, and Germans, eſcaped.—John Utenhovius relates, that in a plague in Denmark, all ſtrangers, as Engliſh, Germans, and Hollanders, eſcaped; although they reſided in families, and aſſociated freely with the infected. The Sudor Anglicus, when it firſt appeared in England, attacked none but the Engliſh; but in ſubſequent peſtilential conſtitutions, it invaded almoſt all Europe.

We have in America moſt illuſtrious examples of the diſtinction above-mentioned. In the ſweeping peſtilence of 1618, when almoſt all the Indians periſhed, on a tract of three hundred miles in extent, ſome white men wintered in the country, and aſſociated freely with the ſick, without injury. In a ſimilar peſtilence among the Indians on Nantucket, in 1763, not a white man was affected, though never ſo much expoſed to infection. Two or three inſtances have come to my knowledge. A like diſcrimination took place in Egypt, in the time of Moſes.

Sometimes the plague ſingles out particular families. Thus Diemerbroeck obſerved in the plague at Nimeguen, whole families, by a ſecret

ſympathy,

ſympathy, were ſeized all at one time; and in ſome inſtances, where the members of the ſame family lived at a diſtance from each other, in different parts of the city, they were all attacked nearly at the ſame time. What is more remarkable, the ſame fact was repeatedly obſerved, when the members of the ſame family lived in different towns. Of this there were many examples. One man, by the name of Vans Daus, to preſerve his children from infection, ſent two of them to Gorcum, in Holland, to reſide with his friends, and kept the third at home. There was no peſtilential diſeaſe at Gorcum at that time, and the two children remained in health for two or three months; but at laſt both were ſeized with the plague and died, at the ſame time that the father and another child died with it in Nimeguen.—The mother was ſeized, but recovered. About the ſame time, a ſiſter, and two or three other children reſiding with another ſiſter, at a diſtance, and ſeveral more remote relations of the family, all periſhed with the ſame diſeaſe.

So it is related by Evagrius, who was ſurprized at the fact, that particular families, ſometimes only one or two, were arreſted by the plague, while all the other inhabitants of the city remained in health. But he remarks further, that thoſe who eſcaped the firſt year, experienced the like calamity in the next. This fact, by the way, is common, and ſhould have led Evagrius and others

others to obſerve the progreſſiveneſs of the peſtilential cauſe.

Pliny, Lib. vii. cap. l. remarks, that old people are uſually exempt from attacks of the plague; but that all nations are ſubject to peſtilential diſeaſes, which invades them by kinds or claſſes; ſometimes falling on ſervants, ſometimes on nobles, and on others by grades or ranks. Nature, ſays this author, has even preſcribed certain laws to diſeaſes. The laſt remark ſhould have excited the minds of phyſicians to diſcover theſe laws. Such laws certainly exiſt, and epidemics of all kinds are connected in principle.

I have met with other inſtances of diſcrimination, perhaps more remarkable. One is related from John Helurgius, in Bonetus. Collection of Northern Medicine, p. 228. In 1621, when the ſmall-pox raged with great mortality, it was remarked that perſons of the ſame blood, as brothers, couſins, and other relatives, living at a great diſtance from each other, and as far as from Nuremberg to Lyons, in France, were ſeized with the diſeaſe at one and the ſame time. —I draw no important conſequences from this fact, becauſe this diſeaſe is not *limited* to particular families, although it may ſeize one family before it does another.

Another inſtance is related by Van Swieten, vol. xvi. from Heiſter, an author of undoubted credit. At Altdorf, in Franconia, broke out in

1711,

1711, a malignant fever, approaching to the plague in violence, but not with the glandular tumors. This diſeaſe attacked none but the ſtudents or others of the univerſity; but it ſeized them wherever they were diſperſed, in private families, in all parts of the town. It ſeized the profeſſors alſo, and their families; but went no further by infection. It attacked alſo the printer to the univerſity, and his workmen, though at a diſtance from the college; while another printer, contiguous to the college, eſcaped. Students alſo belonging to the univerſity, though at home, as at Nuremberg, were ſeized. It was thus reſtricted in its attacks, and exhibited no infection beyond theſe deſcriptions of perſons.

It muſt not be omitted, that this was a very ſickly period in all the north of Europe. In this ſame year the plague raged in Copenhagen, and it had, in the preceding years, ſpread over Poland, and along the Baltic.

This fact at Altdorf is by far the moſt ſingular that I have found in hiſtory; but that a violent diſeaſe ſhould attack perſons of one blood, and not of another, is leſs ſurprizing. We have recent proofs of this diſcrimination in America. In 1796, three perſons of one name in Hartford, two brothers and a couſin, were ſuddenly ſeized with a violent fever, of a putrid tendency, though in winter, and carried off within a few days of each other. At the ſame time, two or three others

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of the family were ſeized leſs violently in the ſame town, and recovered; and what is more ſingular, two other brothers, one in Litchfield, thirty miles from Hartford, and another in New York, 130 miles diſtant, were attacked nearly at the ſame time, and were very ill, but ſurvived. No infection could have exiſted in moſt of theſe caſes, as the perſons did not ſee each other *.

Another inſtance occurred in Cambridge, Maſſachuſetts, and is ſtated to me by the attending phyſician.

In October 1791, a young woman, belonging to a family in that town, but who had, for two years, lived at the diſtance of three miles from her father's houſe, was ſeized with a putrid bilious fever. Her mother repaired to the place and nurſed her till ſhe was convaleſcent. None of the family viſited her while ſick, except the father occaſionally, and her eldeſt ſiſter. The latter took the place of the mother, for a few days, who was called home to attend two other

* A curious fact is related to me by Dr. Dutton, of Oxford, in Derby. In the year 1795, almoſt every *male* child, born in the beginning of the year, in that and the adjacent towns, died within a fortnight by convulſions; but no female child was affected. This was obſerved to be more frequent in families that had been affected by the ſcarlatina, in the preceding year.

It will be remarked, that this was near the diſtrict of country which had ſuffered by a peſtilential fever and dyſentery.

 children

children who were ſeized with the ſame diſeaſe, and who had never been expoſed to infection. Before theſe recovered, three others were taken with the fever in the ſame family. The three laſt had doubtleſs aſſiſted in nurſing the ſick, or been into their rooms, and therefore might have been infected.

In April following, another of the children, who had lived at a diſtance from the family, and had not been permitted to ſee any of the ſick, was ſeized with the ſame fever at the houſe where ſhe lived. In the ſame month, the father and another child were taken with it at home. Not one of the family, at home or abroad, eſcaped, except the mother, who had nurſed all the ſick, except one, and was moſt expoſed to infection. The diſeaſed were very offenſive, but all recovered, except one; and neither my informant, the attendant phyſician, nor any nurſe or viſitor out of the family, was in the leaſt injured by infection.

MS. letter from Dr. William Gamage.

This diſeaſe was a family peſtilence, which began in autumn, was ſuperſeded by the cold of winter, and revived in ſpring. It reſembles, on a ſmall ſcale, the great plagues in London and Marſeilles, and many others, in which a few caſes occurred in the preceding autumn, clearly marking a peſtilential ſtate of air in that particular city; which

which ſtate was arreſted in its operation by cold in winter, but again exhibited its effects in ſpring.

The limitation of the diſeaſe to a particular family, of the ſame blood, or diſpoſition to be affected by a certain morbid ſtate of air, is a myſterious phenomenon, but the fact is ſo well aſcertained, as to leave no room to queſtion its exiſtence. We can aſcribe it only to a general ſtate of air, fitted to produce injurious or fatal effects on bodies of a particular temperament, which temperament or diſpoſition conſiſts in the nviſible ſtructure or organization. It is demonſtrated, that infection cannot be the only cauſe of the diſeaſes in theſe families, and of courſe we are compelled to admit the exiſtence of another cauſe, which can only be the atmoſphere, for no other cauſe extends its operation to the diſtance at which the effects were produced.

It is on this principle alone that particular perſons or families eſcape the worſt plagues that have afflicted mankind, as related by Evagrius, and all authors on the ſubject, and of which we have numerous inſtances in America. But,

"Why drew Marſeilles' good biſhop purer breath,
"When nature ſicken'd, and each gale was death?"

is the interrogatory of an inimitable poet, which has never been anſwered; for on this ſubject, as

on every other, we are baffled and confounded, when we attempt to reach primary natural causes. The interior organization of animals and vegetables is far beyond the limits of human investigation.

Lord Verulam has left a passage confirmatory of the foregoing principles: "The plague, says this great observer of facts, is not easily received by those that continually attend the sick, as physicians; nor again by old people, and such as are of a dry cold complexion.—On the other hand, the plague soonest seizes those that come out of fresh air, those that are fasting, and children. It is also noted to go in a blood, more than from stranger to stranger."

Works, vol. iii.

It is in analogy with the foregoing facts, that animals of different species are affected with epidemic diseases, which bear a similitude in their predominant symptoms, at different stages of a pestilential constitution of air. Sometimes horses, cattle, and sheep, feel the operation of the destructive principle, at the same time with man. At other times this principle will affect cattle a year before it reaches mankind. Sometimes it first assails the human race, and afterwards the irrational parts of creation. In some years one species of animals is affected; the next year, another. Thus horses experienced the epidemic

of

of 1793, in the vicinity of Philadelphia, in the winter following the plague in that city. The fish in James river died in 1797; the cats perished in 1797; the oysters on the shores of Connecticut sickened in 1794; and the fowls in Connecticut in 1796.

Not unfrequently, the force of the pestilential principle, in one country, seems to expend itself principally on the brute creation; while in the same year, or succession of years, its principal operation, in a neighbouring country, is experienced by mankind. Thus in 1712 and 13, a very pestilential period, the cattle in Italy, Germany, and other places, received the full force of the pestilence in a desolating epidemic; while in Austria, Hungary, and the East, the pestilence fell on men. Thus also in 1770, while a dreadful plague was raging in Turkey and Poland, a mortal distemper swept away the cattle in Holland, Flanders, and some parts of England.

That the great general cause of the diseases among the different species of animals is the same, is obvious from this consideration, that during the same constitution of air, or pestilential period, the diseases of man and beast have a number of similar symptoms; such was the fact in Austria, Italy, and Germany, in 1712 and 13; and such has been the case in the United States.

In conformity with the general principle above mentioned, we observe that however analogous

may be the ſymptoms of diſeaſes in man and beaſt, the diſtempers of one rarely infect the other. Infection is limited uſually to that ſpecies of animals which have an aptneſs to receive the operation of the primary atmoſpheric cauſe of the diſcaſe. Thus diſeaſed horſes do not infect men, nor diſeaſed men horſes. So when a plague attacks the natives of a particular country only, the infection, like the primary cauſe of the diſeaſe, is reſtricted in its operation to thoſe particular people. But this is rarely or never the caſe with the ſpecific contagion of the ſmall-pox and meaſles, in regard to mankind. Authors indeed relate, that hogs, dogs, and poultry, feeding on highly infected articles, or wallowing in the filth thrown from houſes, during the plague, have died with a ſimilar diſeaſe. A few inſtances are mentioned by Diemerbroeck, Boccace, and others. Hodges mentions a diſeaſe taken from a horſe, which ceaſed without becoming epidemic.

But theſe iſolated facts form no exception to the general rule; for ſuch diſtempers never ſpread and become epidemic. They only prove my general doctrine, that the contagious quality of plague is not a ſpecific principle, but a quality capable of every poſſible degree of force; that in its lower or more attenuated forms it affects few or no perſons whatever, but it *may* be ſo concentrated or condenſed, as to deſtroy life, not only in bodies of an aptitude to receive the poiſon, but

but alſo in other ſpecies of animals which have no ſuch aptitude. Hence, the poiſon generated in the clothes of the ſick, when put into cheſts or packages, uncleanſed, in hot weather, may be ſo concentrated or increaſed by fermentation, as to kill almoſt inſtantaneouſly the perſon who opens them. But an infectious diſeaſe thus produced will never ſpread far, without the aid of a ſtate of air which is peſtilential. On the other hand, from thouſands of inſtances in books, and within the knowledge of Americans, who are annually, monthly, and weekly, receiving infection from the Weſt Indies, we know that the infection ſoon diſappears in a healthy conſtitution of air. It may be ſo virulent as to give diſeaſe to the perſons who firſt approach it, but in theſe the diſeaſe is extinguiſhed.

It ſhould be further remarked, as a uſeful hint, that perſons removing ſuddenly from freſh air to an infected place, are doubly expoſed. The increaſe of the peſtilential cauſes is uſually gradual; therefore, perſons who live within their operation are inſenſibly fitted, by the flexible texture of the ſyſtem, to ſuſtain their effects. But ſudden changes are very dangerous. The body will hardly ever ſuſtain great changes in the powers of excitement, when ſuddenly made. Hence the extreme danger of removing from freſh to infected air; and ſometimes of removing from infected to freſh air. The ſudden alteration in the ſtimu-

lence, is very eaſily explained. And what is ſurprizing, Procopius and Evagrius have recorded facts which afford a clue to the ſecret, although medical writers, from their days to the preſent time, have ſuffered them to paſs without notice. Procopius mentions, that the peſtilence which began in 542, ſpread over the earth, but "if it paſſed by a particular country, at firſt, or *ſlightly affected it*, it ſoon returned upon it with the ſame deſolating rage which other places had experienced." Evagrius alſo remarks, that "ſome places were more ſlightly affected;" and in another paſſage he ſays, that "in ſome cities a few families were ſeized the firſt year, and the reſt of the city the year following."

Here we have a clue to the myſtery. The plague ſeizes firſt the cities and towns where the general or local cauſes are the moſt powerful. Thus, the plague of 1575, which puzzled Mead ſo much, commenced in Trent on the Adige, which all geographers agree is a moſt unhealthy place. It next attacked Verona and Padua for a ſimilar reaſon, and afterwards Vicenza, the intermediate town. The general cauſe, in the elements, had been four or five years in operation, producing a fatal ſpotted fever in moſt parts of Europe, continually increaſing in malignancy, until it aroſe to the plague, and its criſis muſt naturally be in places where it was moſt aided by

local

local caufes, or where the general caufe firft increafed to its full force.

The flight peftilences mentioned by Procopius and Evagrius, were the *precurfors* of the fevere plagues to follow; precifely as in London and Marfeilles a terrible plague was preceded, in a former year, with malignant fevers and a few cafes of plague. All hiftory affords a tiffue of proof, that the plague is never an ifolated difeafe, ftarting up fuddenly from infection; but the *crifis of a feries of violent difeafes*. To this I challenge the partifans of fpecific contagion to name an exception.

In America, we are able to folve the phenomenon of the efcape of places intervening between infected towns. We find, without an exception, that when two cities are infected with peftilence, and an intervening place is not, if that intervening town is to be attacked the following year, the precurfors of the difeafe appear there during the peftilence in the towns on each fide of it. Thus the late feries of plagues *began* in New York in 1791, in Water and Front-ftreets, where the local caufes were moft powerful. At this time appeared fporadic cafes of bilious fever, more malignant than ufual, in various parts of the country, every where indicating the commencement of a peftilential ftate of air.

In 1792 thefe indications continued; and in a few

a few cafes appeared the fcarlatina, a new evidence of the reigning conftitution.

In 1793 the crifis arrived in Philadelphia with ferious mortality; and the indications of peftilence appeared in great increafe of mortality in many parts of the country. At the clofe of this year New Haven, which was to be next attacked, began to fhow the forerunners of the difeafe, in the fcarlatina, and in an increafe of mortality of about one-fifth. In the next fummer, 1794, appeared the bilious plague. In the fame feafon appeared the difeafe in Baltimore, diftant from New Haven about 290 miles, while Philadelphia and New York, intervening cities, efcaped. But let it be obferved, that a number of cafes of the difeafe occurred in Philadelphia; and New York, which was to be affailed in the next feafon, produced its precurfors in about thirty cafes of violent bilious fever, ending in the black vomit. Thus, while on the extremes New Haven and Baltimore were feverely vifited, the approaching peftilence was announced at New York by a peftilential atmofphere, of a lefs degree of malignity.

In 1795 appeared the epidemic in New York, and in Norfolk, Virginia; while Philadelphia and Baltimore, intermediate cities, efcaped, although the heat and humidity of the feafon every where rendered the country unhealthy. In this year the peftilential principle fhewed itfelf in New

London

London and Providence in diſtinctly marked caſes of the bilious plague.

In 1796, ſcattering caſes occurred in the northern parts of America. In Newbury Port peſtilence prevailed, but preceded by an increaſe of mortality, its precurſor. The ſame diſeaſe prevailed in Boſton, New York, and Charleſton, while intermediate towns eſcaped.

In 1797 it appeared in Providence, Philadelphia, Baltimore and Norfolk, while New York eſcaped an epidemic, but a few very malignant caſes occurred, ſhowing the exiſtence of the general cauſe.

So far as I can diſcover, not a ſpot on the globe has ever been viſited with peſtilence without its precurſors, ſometimes one, two, or three years, but always for ſome months before its invaſion.*

If we had Bills of Mortality for Vicenza, in the years from 1570 to 1576, or a hiſtory of the diſeaſes in the town during that period, I pledge myſelf that we ſhould find, that during the

* Thucydides relates, that the year of the plague at Athens was remarkably free from other diſeaſes preceding, and that the plague fell ſuddenly on the citizens. This may ſeem an exception to my remark; but is not; for all the neighbouring people were collected into the city, which was beſieged; a circumſtance alone ſufficient to account for the ſudden attack of the diſeaſe.

plague

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plague in Verona and Padua, on each ſide, in 1575, ſome malignant diſeaſe prevailed in Vicenza, which greatly ſwelled the Bill of Mortality for that year, and which announced, with almoſt infallible certainty, the approach of the plague. Inſtead, therefore, of ſaying Vicenza eſcaped the peſtilence the firſt year, when Verona and Padua were afflicted, we ſhould ſay the peſtilence had *commenced* in leſs malignant diſtempers, but its criſis in Vicenza was to be a year later. This is the whole myſtery, and the uniformity of this ſeries of facts, from the days of Procopius to this hour, renders it a matter of aſtoniſhment that medical and other ſcientific men ſhould have overlooked this great law of epidemic peſtilence.

Diemerbroeck remarks the fact, as well as Procopius or Evagrius, that peſtilence does not invade all places at once, but now this place, now that; and thus, in a ſeries of years, extending over the earth. See p. 50, of Diemerbroeck, and the foregoing hiſtory of the plagues in Juſtinian's reign. But no author ſeems to have obſerved the progreſſion of a general peſtilential principle, which, if it does not occaſion plague in two contiguous towns the ſame year, occaſions plague in one, and other malignant diſeaſes in the other, which certainly indicate its approach.

To prove that infection has no concern in this laſt mentioned phenomenon, according to the theory

tions of Mead and others, it may be observed, that the invasion of the disease in cities is perfectly analogous to its invasion of a whole country. The disease rarely begins at one point, and spreads from that, like the radii from the centre of a circle, nor does it follow the nurses and attendants of the persons first seized. On the other hand, it starts up in various distant parts of the town, among people who have no intercourse with the infected. To this it may be alleged, the fevers of Philadelphia in 1793 and 7 are exceptions; but, on critical examination, I find they are not. That in New Haven may be an exception. Thus Evagrius relates, that at the beginning the plague seized particular families, sometimes only one or two, and the rest of the town escaped till the next year.

Savaron, from Gregory of Tours, has well described the first progress of the plague in 590, in the southern cities of France. He says the disease was introduced by a vessel from Spain; the first record I can find of supposed importation by water. But when introduced, it did not seize every house at one time, but left intervals. "*Nam* [illegible] *incendium* *satis per domos* [illegible] *interrupto certi temporis* [illegible] *flamma accensa, urbem* [illegible] *conflagravit.*" vol. viii. 15. The metaphor here employed will appear striking to those who have seen a field of stubble or the woods

woods on fire in a windy day. The fact alſo correſponds exactly with what has been obſerved in London, Marſeilles, and other places, that the diſeaſe at firſt ſtarts up here and there, in remote ſituations; then ſubſides for weeks, perhaps, before it ſpreads and becomes popular.

Thus, in Nimeguen a few caſes occurred in November; then there was an interval of ſuſpenſion; in January more caſes; and in March the diſeaſe began to aſſume the ſhape of an epidemic.

Diem. p. 6.

In London, ſays Hodges, two or three perſons died, in one family, with ſymptoms of the plague in 1664. In the holidays occurred another caſe; but a hard froſt ſuſpended the action of the infection. The diſeaſed were at firſt ſhut up and guarded; but to no purpoſe. An order was iſſued and enforced, that a red croſs ſhould be ſet on infected houſes with theſe words inſcribed, "Lord have mercy upon us."

In May and June the diſeaſe, to uſe the author's own words, "reigned doubtfully;" ſometimes in one part and ſometimes in another; and to uſe Hodges's quaint expreſſion, "it kept up a running fight," alternately inſpiring hope and fear. This deſcription is leſs elegant than that of Baronius, but it expreſſes the ſame ideas of the firſt progreſs of the plague.

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It is ſtrange, however, that the writers ſhould not have ſeen that their facts totally overthrow their own ideas of infection; it being impoſſible that the operation of infection ſhould be thus ſuſpended, and afterwards revived. Froſt totally annihilates infection, although it does not deſtroy the atmoſpheric cauſe of diſeaſes.

Similar, in all reſpects, was the commencement of the plague at Marſeilles in 1720. At firſt a few perſons died ſuddenly, then the diſeaſe diſappeared, and the citizens ſuppoſed it to be ended. Repeated hopes and fears were revived by the alternate appearance and diſappearance of the malady, for ſome weeks in May and June. Yet the author who has related theſe facts, made a book to prove its origin from Levant infection!—ſo abſurd are men when they attempt to ſupport preconceived ſyſtems!

In America, the peſtilential fever has firſt made its appearance in a ſimilar manner. It has every where been preceded by an increaſe of mortality, and in moſt places has appeared in the ſcattering, interrupted manner of the plagues before-mentioned. In Philadelphia in 1797, and ſtill more in 1798, ſcattering caſes occurred in June and July, ſeveral weeks before the arrival of the ſuppoſed fomites from the Weſt Indies. The ſame fact occurred in New York in 1795; ſome caſes appeared two weeks before the arrival of the Zephyr,

Zephyr, the ſuppoſed ſource of infection. In Providence occurred the ſame fact. It has been ſtrenuouſly aſſerted, that the diſeaſe of 1797 was from infection brought into Providence in the ſchooner Betſey from the Mole. On authentic evidence, collected with great care by a reſpectable citizen of that town, I can affirm that there is not the leaſt ground for the opinion; and what utterly diſproves it is, that eight decided caſes of the fever had occurred before her arrival.

The whole ſecret of theſe phenomena is, that infection has uſually nothing to do with the *origin* of the diſeaſe, according to the decided opinion of the learned Diemerbroeck, who ſaw the progreſs of the diſeaſe in Holland, and found it impoſſible to aſcribe it in many places to that cauſe.

The reaſon why perſons are ſeized in remote and ſcattered ſituations, and after different intervals of time, is, that the malignant principle is *progreſſive*. In its ſtate of increaſe, it firſt produces diſeaſes of a leſs violent type, and eſpecially all kinds of eruptive diſeaſes and catarrhous affections, as influenza, meaſles, ſmall-pox, every ſpecies of angina, petechial fever, and, laſtly, plague. In winter, the ſame cauſe often occaſions epidemic pleuriſy, or peripneumony of a moſt mortal kind, and always bearing ſome likeneſs to the epidemics of ſummer and autumn.

[illegible] peſtilential [illegible] who have [illegible] This [illegible] It [illegible] organization [illegible] being naturally more [illegible] This indiſpo[illegible] action of air [illegible] man; [illegible] every day's [illegible]

[illegible] are pre-diſpoſed to certain diſ[illegible] Thus every exceſſive [illegible] cauſe of [illegible] Hence the liability of robuſt people to [illegible]

[illegible] peſtilential diſeaſes, [illegible] where the peſtilential [illegible] by the debilitating [illegible] Hence the early appearance and [illegible] ravages of the plague in the narrow ſtreets of cities, and filthy apartments of poverty.

From theſe and other cauſes, it happens that ſome perſons are ſeized with peſtilence long before the bodies of others yield to the action of the deſtructive cauſe. This will rationally account for all the variety of phenomena which accompany this furious malady.

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The ſame reaſoning applies to the angina maligna, which is another form of peſtilence. Fothergill relates, that this diſeaſe appeared in London in a few caſes in 1739, and then diſappeared for a period of two or three years. It did not become epidemic, though very infectious.

Works, p. 198.

To confirm this hypotheſis, I may remark that the plague is leſs infectious on its firſt appearance. This is admitted by Ruſſel, on the plague of Aleppo, p. 19, 300, 297, and 315. At the ſame time, it is agreed on all hands to be more mortal than in its later ſtages. If infection were the cauſe, the reverſe would be true, and the diſeaſe would be more mortal in proportion to the extenſion and the accumulation of infectious matter. The firſt caſes alſo would be equally infectious, within the reach of their effluvia.

Stenkius obſerves, that many perſons lived in infected houſes, where others were diſeaſed, for three or four weeks, without any ill effects; but they afterwards ſickened and died. This he aſcribes to an increaſe of infection, and recommends, as the means of prevention, changes of clothes and liberal uſe of water in the apartments. The fact may be explained on this principle; or it may be, and moſt probably is, the effect of the ſlow operation of the morbid air in inducing debility on particular ſyſtems. But it goes to prove

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that the infection of the disease is not specific contagion, but a vapour or acid, unfriendly to health, that is capable of every imaginable degree of force; slighter degrees of which require a long time to undermine the energies of life.

Another consideration, which decides against the origination of the plague from infection, is, that almost all other diseases, whether infectious or not, exhibit the phenomena just described. It is not the plague alone that appears this year in one town, and the next in a contiguous one; or this week in one family, and the next in another; or at the same moment in two families or towns, at some miles distance. The same phenomena characterize dysentery, measles, anginas, and other maladies which are infectious; and even intermittents, remittents, and some others which are not spread by infection.

Such was the manner in which the fatal dysentery of the period about the year 1751, leaping from place to place, in different years, ravaged Connecticut for three or four years. The same took place, with that disease, from 1773 to 1777. It was scattering from place to place during a series of years, and then almost totally disappeared for many years. Sometimes it spread over a whole town; at others, it was limited to a particular street. In some instances, it swept away a large part of a family; in other instances, families entirely escaped. The same has been its progress

grefs during the laft five or fix years. In 1794 it ravaged Derby; in 1795 New Haven. In 1798 it invaded a particular ftreet in the country, two miles from Stamford, was infectious and mortal, while the town generally efcaped.

The fcarlatina, from 1793 to 1796, exhibited the fame facts. Its general progrefs was eaftward, but it often paffed by a town and firft feized one beyond it.

The angina maligna, in 1735 and 6, was remarked for the fame manner of appearance. It began in Kingfton, in New Hampfhire, but inftead of a regular progrefs, ftep by ftep, it feized Bofton, fifty miles diftant, before it did Chefter, only fix miles diftant; yet its general progrefs was weftward, and hardly any place efcaped. Both this difeafe and the fcarlatina of the laft period, refembled the plague in thefe other refpects—they were moft mortal at firft; and they affected families with very different degrees of violence, flightly troubling fome, and extinguifhing the lives of all the children in others.

The invafion of the influenza exhibits fimilar facts. It feizes at firft only here and there a perfon; afterwards it becomes general, as at Edinburgh in 1762. See Effays and Obf. Edin. vol. iii. At other times is has feized whole towns in a night; nor does it proceed from town to town, according to their order on a map. Yet its *general* courfe is in one direction.

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I could produce a multitude of fimilar inftances of pleurify and common autumnal fevers not infectious, which appear one year in one part of the country, and another in another, without any vifible caufe for this variety. The inftances related by Dr. Buel, of the town of Sheffield, are very diftinguifhed. See my Collection on the Yellow Fever, p. 53 and 60. That town contains two large ponds, which make confiderable marfhes, that are fources of remittents. In 1794 remittents of unufual violence appeared within the miafmata arifing from the fouth pond—in 1795 a fimilar fever raged in the vicinity of the north pond.

This appeared at firft an unaccountable phenomenon; but afterwards, the fever about the fouth pond in 1794, was afcribed to the drawing off the water, and expofing great quantities of putrefcible fubftances to the action of heat. But ftill the difficulty is not removed. The north pond is admitted to be the moft ufual and fruitful fource of difeafes; but thefe did not appear in any extent in 1794. The queftion then is, not why the difeafes occurred in that year about the fouth pond, but why they did *not* appear about the north pond, the principal focus of ficknefs in other years, and about which they raged with melancholy effects in the two following years? No alteration is fuggefted to have been made in the circumftances of the north pond; yet in one year its

exhalations were almoſt harmleſs, and in the next they ſpread deſolation over the neighbourhood.

See Medical Repoſitory, vol. i. p. 458.

In ſuch caſes, juſt reaſoning leads us to ſuppoſe the general ſtate of the air, or the local exhalations, or both, differ materially in the degrees of their force and activity in different years; but to human eyes the cauſe of this difference is not often viſible.

Sometimes a ſevere epidemic will rage in one town, and a milder epidemic of a ſimilar type in the vicinity. Thus Zimmerman obſerves, that he has known a violent diarrhea follow a ſuppreſſed perſpiration in September, in one town, when the dyſentery was epidemic in the neighbouring country. To what ſhall we impute this difference of diſeaſes, within a few miles of each other, but to the different force of local cauſes? A general cauſe, as a hot ſeaſon, may pre-diſpoſe the body to a diſeaſe of a particular type, but this principle may be modified by innumerable circumſtances on the ſurface of the earth.

In analogy with theſe facts, is the manner in which peſtilential diſeaſes invade different ſpecies of animals. In one place horſes are ſeized; in another cows; in a third ſheep. In one year cats fall victims to peſtilence; and the next hens and geeſe; but infection has no concern in theſe phenomena; and we are to aſcribe them to the

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various force of the peſtilential principle in different ſeaſons and places.

The phenomenon now under conſideration has not eſcaped the obſervations of other phyſicians in Europe. Stapfer, cited by Zimmerman on phyſic, relates that the village of Oberwyl, in the Canton of Berne, was attacked with a violent dyſentery in 1749, while the neighbouring villages were free from the diſeaſe. In the next year Oberwyl was healthy, while the neighbouring villages were ravaged with the ſame diſorder, though not ſeparated from the other by any mountain or foreſt. I have occaſion, ſays Zimmerman, to obſerve ſomething like this almoſt every year.

The Engliſh editor remarks on theſe facts, that "the dyſentery, like other contagious diſeaſes, is ſpread by communication with the infected perſons and clothes, and, *therefore*, it is not ſtrange that one village ſhould eſcape, if its inhabitants were careful to avoid communication with their infected neighbours."

Juſt ſo important are all the reaſonings of the infection-ſticklers! The remarks are commonplace, and do not reach the point of difficulty. The queſtion is, to know why ſeveral villages eſcaped the diſeaſe in the year when infection was *near* them, and were ſeized the next year when no infection exiſted. The winter's cold totally extinguiſhes the infection of that diſeaſe; ſo that the learned editor is left without a reſource. If

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any infection had survived the frost of winter, it must have been in the village first infected, and in that place common sense and observation would teach us to look for a revival of the disease the succeeding spring. But no; that village is in perfect health, and others, where there had been no fomites, are laid waste by its ravages. Such are the facts, and no theory of contagion is able to explain the cause of their existence, in regard to this or any other disease.

The dysentery also has, in some places, made the discrimination observed in the plague; seizing persons of a certain nation or blood, and not affecting others who are equally exposed. In an epidemic dysentery in Nimeguen, the French and Jews all escaped.

Van Swieten, vol. xvi. p. 57.

There is a fact related by Hodges and Diemerbroeck, respecting the plague, which must not be omitted. Many persons who had breathed the pestilential air of London and Nimeguen, went into the country, where they had the benefit of good air. Here they lived in health a month or two, then sickened and died of the plague. This is attributed to the latent poison, which lies long inactive in the system, then operates to the destruction of life. This may be the cause; but is it not more natural to ascribe the fact to higher excitement from a pure air, on a debilitated system, inducing indirect debility? Or shall

ſhall we ſuppoſe that a peſtilential atmoſphere is moſt ſtimulant, and that a removal into pure air induces direct debility? Perhaps the following facts will throw ſome light on the ſubject.

In 1789 I left Hartford in October, when the influenza was ſpreading in that town, and was ſeized with the diſeaſe juſt after I arrived at Boſton. A fortnight after I returned with two ladies who had lived in Boſton. In a week after my arriving at Hartford, the town of Boſton was attacked with the influenza, and the two ladies at Hartford were ſeized at the ſame time. The concluſion I draw from the fact, is, that the conſtitution of air producing the epidemic is ſome time in operation before its effects are viſible, gradually inducing a diſpoſition in the ſyſtem to that diſeaſe; and as it is progreſſive, it requires about the ſame time to run through its courſe in one place as in another, and is not always interrupted by local cauſes.

But the moſt incontrovertible evidence that infection is not the primary controlling cauſe of the plague, ariſes from the manner in which that epidemic ceaſes.

If infection were the principle and ſpecific cauſe of its propagation, it muſt rage for ever, or as long as any of the human race ſhould ſurvive to receive it; for the longer the diſeaſe exiſts, the more extenſive muſt it be. This concluſion is inevitable; for if infection ſpreads the diſeaſe ſo rapidly, that one or two diſeaſed perſons dif-

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fuſe it in a few weeks over a city, the ſame principle muſt, in a given time, extend it over the whole earth, unleſs its operation ſhould be arreſted by a ſuperior cauſe. And as one diſeaſed perſon is ſuppoſed to infect more than one healthy perſon, its progreſs will be accelerated in a duplicate, triplicate, and quadruplicate ratio to its diſtance from its ſource. Its velocity alſo muſt be increaſed, not only by numbers in a crowded city, but by an augmented virulence, until all the inhabitants ſhould be deſtroyed. But all this is contrary to fact.

Moſt plagues are modified and regulated by the ſeaſons; but the ceſſation of peſtilence in different countries is in different ſeaſons, and ſeems to depend on oppoſite principles. In Egypt, a warm country, never reached by what may be called *cold*, the plague begins in winter, as in December, January, or February, after the Nile has ſubſided within its banks, leaving extenſive plains and numerous canals expoſed to a hot ſun; with a ſlimy ſurface and ſtagnant waters in abundance on the face of the country. During this period alſo blow the ſoutherly and ſuffocating winds, hot and duſty, from ſandy deſerts, which may augment the cauſes of diſeaſe.

On the other hand, the diſeaſe ceaſes in June, when the Nile overflows its banks, ſpreading freſh water over the face of the country; at which time

time alſo begin to blow the cool refreſhing Eteſian breezes from the North or Mediterranean ſea.

Hence it is obvious, that the exiſtence of the diſeaſe depends on the general ſtate of the atmoſphere; for the inundation of the Nile certainly does not waſh away the infection from the houſes and clothes of the ſick. On the other hand, the plague ceaſes when the infection is moſt general; and this is true in every inſtance.

It may be ſaid, that the plague ariſes from putrid exhalations in Egypt; and the reaſon why it ceaſes on the riſing of the Nile, is, that the expanſion of freſh water over the country, and a pure northerly air, deſtroy theſe exhalations.

In this obſervation there is truth, and it would account for the origin and ceſſation of the plague, if it was an annual diſeaſe, regularly influenced, and entirely governed by the ſeaſons. But here again we are overthrown; for in moſt years putrid exhalations, which always exiſt at a certain ſeaſon, do *not* produce the diſeaſe. Thus we are driven to ſeek another cauſe which is *not* influenced by ſeaſons; and to ſuppoſe its *co-operation* with hot winds and ſtagnant waters in the generation of the diſeaſe. This is moſt undubitably the fact.

Again, the plague in Syria, farther North, where ſome winter's cold is experienced, begins in ſpring, as in February or March, and ends in June and

and July, during the most excessive heat of the summer. This is the fact from Aleppo to Jerusalem, and has been from the earliest records extant.

Here then different causes, extreme heat and drought, seem to control the rage of the plague. But does heat destroy infection? Never, unless by combustion. No degree of heat that is ever felt in the tropical regions, or in America, has ever mitigated the force of infection, but always has increased it. Now we know that the heat of Syria never exceeds in degree what is annually experienced in the West Indies and the United States, to the forty-second degree of latitude certainly, and probably to the forty-fourth. In one respect Syria differs from this country; the summers are longer than in the northern States of America, and the climate subject to drought. But it cannot be the duration of the heat which destroys the plague; for that disease ceases at the very beginning of summer. It abates in June, and rarely appears to any extent as late as August. Nor can we conceive why drought in Syria should put an end to the epidemic; for in most *other* countries it has not that effect. In Europe and America extreme drought has very often inflamed its violence.

In this instance, then, we find no cause for the cessation of the plague in the weather or seasons which we are able to comprehend. We know the

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uniformity of the fact; and all beyond this is conjecture. Infection can have no concern in the effect, unlefs on fome principle hitherto unknown; cool weather generates it, and heat deftroys it, contrary to facts in all other countries.

Certain it is, that the plague at Aleppo, Damafcus, Said, Jerufalem, Latakia, and on all the Syrian coaft, ceafes in extreme hot weather, and when the infection is in its utmoft extent and violence. In Italy, Conftantinople, in all Europe, and the temperate latitudes of America, ordinary plagues yield to cold; that is, they ceafe as epidemics of that form; but the general caufe never fails to fhew its influence in giving to the diforders of winter fome of the general fymptoms which characterize the epidemic of the fummer. This proves, that in common peftilence, morbid exhalations *aid* the atmofpheric caufe in producing the epidemic; and that it is not fpecific contagion which contributes to fpread the difeafe; for this is not influenced by cold, but it is morbid exhalations that yield to cold. Hence, in northern climates, cold fufpends the action of the two fubordinate caufes of peftilence, morbid exhalations and infection; and this is ufually fufficient to check the epidemic.

But that the great primary caufe is not affected, or rather fubdued by cold, is apparent from thefe facts; that, although the plague, in its peculiar autumnal form, is fufpended, yet the dif-

diseases of winter, as pleurisy and peripneumony, wear the same livery, which can be occasioned only by the continued action of the same cause. Further, some plagues have not yielded to cold, as I have before observed. Several instances have occurred in which the disease has run through all the seasons without interruption or abatement. This fact demonstrates, that the primary cause existing in the essential properties of the elements, may be of various degrees of force, and does at times actually arise to a degree capable of producing and continuing that disorder, not only without the aid of morbid exhalations and infection, but in defiance of cold.

In conformity with this idea, is the fact that a pestilence which begins the earliest in the season, is the most mortal. This is agreed by P. Alpinus, Van Swieten and Sydenham. "*Minus sæva est, quo tardius illuc accessit, viderique incipit; ita ut quo tardius venerit, eo mitior ac brevior sit judicanda,*" says Alpinus, Rerum Egypt. vol. iii. 70. The reason of which is, that in proportion to the strength of the elemental cause, it begins to exhibit its effects early in the season; that is, with the *least aid* from heat, noxious effluvia, or other local causes. If the general contagion of the atmosphere is very powerful, its effects may appear even in winter in opposition to cold. Hence the justness of Diemerbroeck's remark, that pestilence beginning in winter is the most

moſt fatal. If, on the contrary, the general conſtitution of the air is leſs hoſtile to life and health, it will not produce an epidemic peſtilence till it is aſſiſted by great heat and local vitiation of the air; therefore the diſeaſe will not appear till late in the ſeaſon.

Something like this, on a ſmall ſcale, has characterized the different epidemics in Philadelphia. In 1793 the precurſors of the epidemic were light, and the firſt caſes did not appear till the laſt of July, or beginning of Auguſt. In 1797 and 98 the firſt caſes occurred in June, and the diſeaſe in the latter year was marked with by far the moſt malignant ſymptoms, although the timely evacuation of the city prevented Bills of Mortality equal to that of 1793.

In New York this circumſtance, it is believed, has been leſs noticeable; but it may be remarked, that in the years of the epidemic the firſt caſes occurred in the laſt week in July, and in years when a few ſporadic caſes * only have

* The advocates of the ſpecific contagion of the plague do not admit that the true plague ever appears in ſporadic caſes. They think, if it once appears, its contagion muſt of neceſſity ſpread it. This is all a whim. I believe, with Dr. Mitchel, that any diſeaſe, of the worſt type, may be generated in the body ſolely by a derangement of the functions of the ſtomach and inteſtines, and the poiſonous air extricated from food. But that ſporadic caſes of plague may occur, and do occur very often, I have not the leaſt doubt. During

have appeared, they have not occurred till many weeks later. Befides, it is very obvious that the difeafes of 1795 and 6, if not 1797, were powerfully influenced in their commencement by local caufes, as great maffes of putrid matter in the parts of the city where the firft cafes occurred, and where the epidemic exhaufted its principal force.

In general, it may be obferved in our climate, that if a malignant fever does not appear in a city till late in Auguft, the citizens need not apprehend very general defolation. If cafes occur early, as in June, there is ferious ground for apprehenfions of danger. The only exception to thefe remarks, is, when the feafons fuffer fome great, unufual, and fudden viciffitudes, which during a peftilential period may overwhelm a city with almoft inftantaneous calamity. Such may be a fudden invafion of heat in Auguft after preceding cool weather.

In general it is a juft remark, that as the force of the peftilential principle is of various degrees in different periods, fo when it is moft

During the late war in 1776 or 1777, two brothers, by the name of ——, arrived from the army at Greenwich in Connecticut; one had a malignant fever with glandular tumours; the other was his nurfe, and in good health. The fick man died foon after he arrived, and in lefs than twenty-four hours his brother was alfo in his grave. This was true plague; but no other attendant was infected.

 powerful

powerful it attacks men the earlieſt in the proper ſeaſon, and is deſtined to be moſt deſtructive.

The preceding facts and concluſions ſeem ſufficient to eſtabliſh the great point, that neither contagion nor infection has ever had much influence in originating or propagating peſtilential epidemic diſeaſes of the autumnal kind.

But objections remain to be anſwered. It is alleged that the plague begins in maritime places, and thence ſpreads into the country adjacent. Thus is it aſſerted by the College of Phyſicians in Philadelphia, that the peſtilential fever in America "commences invariably in our ſea ports, while inland towns, equally expoſed to the ordinary cauſes of fever, eſcape."

Memorial, dated Dec. 5, 1797.

Pliny, a great obſerver of facts in the natural world, goes farther, and aſſerts, "that peſtilence is obſerved always to proceed from ſouthern regions towards the ſetting ſun; nor does it ſcarcely ever happen otherwiſe, except in winter."

Lib. vii. Cap. 50.

Mead, and the author of Traité de la peſte, have cited this opinion with approbation. By the words of Pliny, "*a meridionis partibus ad occaſum ſolis*," muſt mean from Egypt and the Barbary coaſt, towards Italy, Gaul, and the other weſtern parts of Europe.

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From these facts is inferred a strong argument in favour of the propagation of that disease by contagion.

With deference to these great authorities, not one of these assertions is accurate. That the plague generally appears first in sea ports, is a just remark; and, according to the laws of nature, it must be so without infection. But to this rule there are many exceptions. The general plague, in the days of Thucydides, originated in Ethiopia near the borders of Upper Egypt, *not a sea port.*

The violent plague in 252 began in the same region; as did that of 1736.

The plague of 542 began in Lower Egypt, between Pelusium and a morass called the Serbonian bog, at a distance from the port of Pelusium. It should have been mentioned, that the mortal plague in the reign of the Antonines began in Selucia, on the Tigris, far from the sea. The black pestilence of 1348 originated in China. That in 1450 in some part of Asia. The pestilence of 1348 began, when it first appeared in France, in Avignon, *not* a sea port; as did that of 1482. The plague of 1575, in Italy, began at the northward in Trent, and proceeded southward, contrary to the assertion of Pliny; and every one knows Trent is not a maritime place. The plague in Holland, in 1663, began in Heusden, *not* a sea port, but on a river, and near a

a morafs. In 1702 a plague broke out in Poland, far from the fea.

With refpect to the United States, the affertion of the College of Phyficians muft ftand or fall, according to the definition of the fevers which have appeared in the country. If no peftilence has ever appeared, except in fea-ports, we muft affix fome other name to the mortal epidemics that vifit the interior of our country. Certain it is, contrary to the ftatement of the College of Phyficians, that the true yellow fever, and fo called at the time, prevailed in Albany in 1746, and probably no where elfe in the northern ftates, though a fickly year.

About the marfhes in the interior of our country, an epidemic bilious fever has, times without number, raged as fatally as ever it did in Philadelphia, deftroying life in three or four days, attended with all the characteriftic fymptoms of yellow fever, and carrying off almoft every perfon within the region of its atmofphere. This has happened about fome of the lakes in the State of New York every year fince the prefent peftilential period commenced, and whole villages have been depopulated If the College of Phyficians choofe not to call this difeafe yellow fever, I cannot help it; but fure I am, if it is not that fpecific diforder, it is one equally defolating, and as little entitled to be fathered on the country as any fpecies of plague whatever. It is a fact alfo, that

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the bodies of thoſe who periſh by that fever, near rivers and lakes, are, if poſſible, more yellow than in cities.

But what utterly diſproves the aſſertion of the College of Phyſicians, is, that the ſame peſtilential diſtemper which has lately afflicted our cities, appeared among the aborigines of this country before it was ſettled by the Engliſh, before the Weſt Indies were ſettled by the Engliſh or French, and before a ſingle veſſel from the iſlands had ever reached our ſhores. To confirm this fact, it is well known that the ſame diſeaſe has often viſited them, ſince the Engliſh ſettlement, and in ſituations and under circumſtances when it was not poſſible for them to receive it from infection, as at Nantucket and Martha's Vineyard in 1763, and ſeveral times in the limits of the preſent State of Rhode Iſland. The Onandagoes in the State of New York, three or four hundred miles from a ſea-port, about eighty years ago were attacked with peſtilence, which waſted the tribe; and the place where the village was then built, has, on the account of that mortality, been ever ſince abandoned, and is now over-grown with trees.

What the diſeaſe was I am not informed; it might have been the ſmall-pox; but the country where it happened is now ſubject to mortal bilious epidemics, which kill in three days, and turn the body as yellow as ſaffron. Beſides, the great plague in 1618 is known to have been the

true infectious yellow fever, and so was the fever of Nantucket in 1763, neither of which could possibly have been imported.

About sixty years ago a great mortality happened among the Indians on the north-east of a small stream, a little south of East Greenwich, in the State of Rhode Island. The disease was fatal to almost all who were affected; but it was local and infectious; for a law was passed that no person should go from one side of the river to the other, and the Indians on the opposite side remained in health. This place was no sea-port, but an Indian hamlet; and no pretence of importation is suggested, nor does it appear that any whites were affected.

About twenty-six years ago a malignant bilious fever attacked the Indians at Quidnesit Neck, in North Kingston, in the same State; and most who were seized perished. It attacked also a few families of whites, but with less mortality. North Kingston is a sea-port; but there is no suggestion of foreign origin.

MS. of Moses Brown, of Providence.

From these facts let the public judge how little reliance can be placed on general assertions, even of learned and respectable societies, when made without a critical examination of the subject.

It

It is proper that I ſhould here take notice of an aſſertion found in a number of authors, "That Thucydides relates the plague in his days to have ſpread from Ethiopia by means of contagion, infection, or fomites." The learned Diemerbroeck has fallen into this miſtake. p. 48.

Galen is more correct, when he ſays that peſtilence ſpread by the corruption or infection of the air. This idea, though not the expreſſion, is accurate.

The truth is, Thucydides does not ſay that the diſtemper ſpread by infection or contagion. The literal tranſlation from the Greek is as follows: "It began, as it is reported, firſt from Ethiopia, above Egypt; then it fell on Egypt and Lybia, and a great part of the king's dominions (Perſia). It then ſuddenly invaded the city of Athens, and firſt the Piërœus." In the paragraph preceding, he ſays, the diſeaſe had prevailed in many regions, firſt and eſpecially at Lemnos, but does not hint at infection or contagion as the cauſe.

The obſervation of Pliny, that peſtilence originates in ſouthern climates, and proceeds northward and weſtward, is generally, but not always true. Alexander Ruſſel tells us, the peſtilence in Aleppo, in 1719, came from the northward; and many authors relate that it appears in Conſtantinople or Smyrna before it does in Egypt. This may be partly owing to alterations in the Turkiſh cities ſince Pliny's time.

But on juſt principles the fact is rationally explained. If a particular ſtate of air, favourable to the propagation of that diſtemper, muſt exiſt before it can become epidemic, which is admitted by the friends and foes of contagion, then ſuppoſing this *general* peſtilential principle to exiſt at a given time, in equal force, all over the earth, or any portion of it, it muſt follow inevitably that this general cauſe will produce the worſt diſeaſes *firſt* in climates and ſituations where the moſt powerful *local* cauſes exiſt, as heat, moiſture, and all kinds of deleterious exhalations. And for a more obvious reaſon, the debility of the human body muſt be firſt induced in thoſe ſituations.

This is a complete ſolution of the fact mentioned by Pliny; and he himſelf juſtifies the explanation of it; for he excepts from his own general rule the peſtilence that appears in winter; a circumſtance paſſed over by Mead. Now the reaſon why a plague beginning in winter does not follow the courſe of one beginning in ſummer, but appears ſometimes in northern climates *firſt*, is, that ſuch a peſtilence does not require the aid of contingent cauſes, as noxious exhalations. It is independent of *local cauſes*, and induced ſolely by the eſſential qualities of the air; it may therefore appear firſt in any place or climate whatever, according to the ſtate of the air. This happens only in great plagues, which ſeldom occur.

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Theſe obſervations apply alſo to the objection that peſtilence firſt appears in maritime places, as mentioned by Procopius and others.

It is a fact known to every medical man, that humidity is a cauſe of debility. Hear what the learned Zimmerman ſays on this point:

On Phyſic, vol. ii. p. 100.

"The humidity of air weakens a man ſuddenly; it relaxes the ſolids, and of courſe weakens the circulation, ſo that the ſecretions are carried on with difficulty. The inſenſible perſpiration is checked, the moiſture paſſes in through the abſorbing pores of the ſkin, and the patient feels a laſſitude and heavineſs which deprive him of all his gaiety, and render the mind as oppreſſed as the body."—"Damp ſituations are, in every country, unhealthy."

p. 102.

There is not a perſon living who cannot teſtify to the truth of theſe remarks. Hence the languor which depreſſes a man in a hot, ſultry day, with a ſoutherly, light air, *loaded with vapour.* Hence this ſtate of the air, when of long continuance, never fails to generate epidemic diſeaſes; and if it occurs during a peſtilential conſtitution, mankind ſeldom eſcape the ravages of the plague.

It may be ſaid that the inhabitants of maritime towns are leſs expoſed to this ſource of debility than

than ſeamen, who are in general remarkably healthy. To which I anſwer, that the ordinary moiſture from ſea-air never of itſelf produces diſeaſes; and at ſea there exiſts no exciting cauſe, as morbid exhalations, unleſs in ſhips of war and crouded tranſports, in which diſeaſes often proceed from human effluvia. But I queſtion whether the bodies of ſeamen poſſeſs the ſame firm texture as thoſe of labouring farmers in the country. Certain it is, that ſeamen in general are not ſo long-lived men as farmers. This is aſcribed to their irregular and ſevere fatigue; but I ſuſpect it more owing to the inceſſant operation of the debilitating powers of moiſture.

Whatever may be in this, it is certain that moiſture of *itſelf* induces debility, in a greater or leſs degree, though not diſeaſe; but when its action on the ſyſtem is combined with the operation of morbid exhalations, which abound in cities, eſpecially near navigable water, together with the frequent alternations of heat and cold, occaſioned by the contiguity of land and water, we are not to be ſurpriſed that cities on the borders of the ocean, and the banks of rivers, are the firſt to be attacked with peſtilence. We might, without the aid of facts, prove *a priori* that this muſt generally be the caſe.

Hodges mentions that the London plague of 1665 ſpread into the adjacent country, *eſpecially along the Thames*; but he takes care to aſcribe

this to infected goods, and not to humidity—another proof of the mischiefs of theory.

Indeed the circumstance that, next to large maritime cities, the towns situated on the borders of rivers or lakes are the most severely harassed with epidemics of a fatal kind, especially autumnal diseases, is an evidence of the truth of the same principle. Wherever we turn our eyes, we see autumnal diseases, from simple tertians to the plague, most frequent and most deadly in low situations, under the combined operation of heat, moisture, and different species of noxious exhalations. It is therefore as unphilosophical to deduce, from this fact, arguments in favour of the foreign origin of the plague, as in favour of the importation of many other malignant diseases; for the same phenomena attend them all—they all appear *first*, and are most epidemic and fatal, in the vicinity of water. This is their general rule, to which exist some exceptions, as well in regard to the plague as to other bilious complaints.

But the discovery of a general pestilential principle, extending over a whole hemisphere, or the whole globe, nearly at the same time, or with a rapid progression, solves all the difficulties on this subject. Had Pliny known that, at the moment a severe plague appears in Egypt the diseases of all Europe, or all the world, assume unusual malignancy, or other contagious and infectious epidemics appear in every quarter, to the distance of

of a thoufand leagues, his remark would have been equally juft, as to the origin and progrefs of the plague, but it would have opened to him new caufes of its origin, and a more juft and philofophical view of the phenomenon. This is a difcovery which proftrates all theories of fpecific *contagion*, and reduces the influence of *infection* to its juft meafure.

Another fact. Foreftus has declared, that in peftilence three times the number died in wet weather as in fair and dry weather; the infection being lefs eafily difperfed in wet weather, which is evident from the fmoke of chimnies.

Van Swieten, Vol. xvi. p. 26.

It is well known in America, that while the weather is hot, rains and moift air greatly multiply cafes of peftilential fever.

In 1720 a ftorm of thunder and lightning at Marfeilles, late in July, was followed by a great increafe of the plague.

Traité de la pefte.

Every one knows that the air along the borders of the ocean corrodes iron and other metallic fubftances. Is it not then queftionable whether the faline acid, which impregnates the maritime air, has not fome deleterious effect on the human body, when combined with other vapours from the earth? Are we yet acquainted with the effen-

tial properties of all the poſſible combinations of aërial ſubſtances?

Again; Mead has remarked, that countries and cities which have had moſt commerce with Africa, as Marſeilles, have been moſt frequently afflicted with the plague. A French author, he ſays, reckons twenty plagues that have infected Marſeilles, notwithſtanding its healthy ſituation.

In oppoſition to this, it may be proved by facts, that the cities in the interior of Germany, that never had any trade or communication with Egypt, uſed formerly to be haraſſed with that diſeaſe, nearly, if not quite ſo often, as the maritime ports of England, France, Spain, or Italy. Any man will learn this who reads the whole hiſtory of that calamity, inſtead of that of a few detached inſtances.

As to the twenty plagues of Marſeilles, aſcribed to the trade with Egypt, I would obſerve, that I can produce the hiſtory of nearly double that number of violent plagues in London, *before* that city had any trade or connection with Egypt.

Equally ill founded is the idea of medical writers, that the yellow fever of the Weſt Indies was brought firſt from Siam. "Maladie de Siam" is the name given to it by French phyſicians, and this improper name will ſerve to perpetuate the error, while it ſhall exiſt as a monument of ignorance

ignorance and falſe philoſophy. This pretended Siam fever was the peſtilence of the Indians on this continent, before the Weſt India Iſlands were ſettled by the French.

Another extraordinary aſſertion of Mead is, that "the northern nations of Europe, before their connection with Africa in trade, grew populous more rapidly than in modern times."

I will not conteſt the aſſertion, as it regards the degree of population of thoſe countries in different periods. Authors differ in opinion on the ſubject of the ancient population of Europe, and no certain documents or facts exiſt by which the point can be aſcertained.

But the implication neceſſarily deduced from Mead's aſſertion, is, that the plague is more frequent and deſtructive in the north of Europe ſince a trade has been opened with Egypt than before; for on this principle only would he account for the reduced population of modern times. If this is what he meant to inſinuate, the aſſertion is not ſimply inaccurate, but abſolutely falſe. From the firſt accounts we have of Ruſſia, Poland, and the Baltic regions, to the firſt opening of a trade with Egypt in modern days, plagues were much more frequent and fatal in thoſe countries, than they have been within the laſt century, ſince a conſtant trade has been carried on with Egypt and every part of the Levant.— For the truth of this aſſertion I appeal to facts.

In

In the year 1485 the English first opened a trade to the Mediterranean, especially with Italy, and a consul was appointed, resident at Pisa. The act of appointment by Richard III. contains this passage; " Whereas certain merchants and others from England, *intend* to frequent foreign parts, and chiefly Italy, with their ships and merchandize." —Before this England had little or no trade *directly* with foreign countries. All her trade was conducted by Lombards, Genoese, Venetians, and the Hans merchants. There was no direct trade to Egypt and the Levant.

About the year 1511, English ships began to frequent Sicily, Candia, Chios, and the Syrian coast; but this was accounted a very hazardous voyage, and ships seldom made it in less than a year.

In 1535 English factors first settled in those countries.

See Anderson's Commerce, vol. i. p. 683. vol. ii. p. 79. Rymer's Federa, vol. xii. p. 261. and Hackluit's Voyages, vol. ii. p. 96.

Now the fact is, that the plague was as frequent and severe in England, Denmark, Sweden, and Germany, in the tenth, eleventh, twelfth, and thirteenth centuries, before any foreign trade existed, as in any later period. Not to mention the universal plague in the days of Vortigern, about 448, which never has been exceeded in extent

extent and violence, unleſs by the black peſtilence of 1348.

The Levant company was firſt eſtabliſhed by Queen Elizabeth in 1581, and the act of incorporation expreſsly ſtates, that Sir Edward Oſborn and his aſſociates, the perſons incorporated, had, at their own great coſts and charges, *found out and opened* a trade to Turkey. Before that time, the commodities of Egypt, Syria, and Turkey, were all imported from Italy in Venetian or Genoeſe ſhips.

The commerce of the north of Europe, from the year 1200 to 1500, was almoſt wholly in the hands of the Heanſeatic Confederacy; but, on careful inveſtigation, I cannot find the leaſt trace of a direct trade to the Levant by the towns in that league. Indeed before the diſcovery of the mariners' compaſs in the fourteenth century, all trade was carried on by coaſting. Hiſtory records more than one hundred general plagues before that diſcovery. So totally falſe is the aſſertion of Mead.

'But, ſay the College of Phyſicians in the memorial before cited, " Proper health laws, ſtrictly enforced, have latterly protected the commercial parts of Europe from its ravages."—This is a point of importance, and while the aſſertion ſtands unſupported by proof, I am at liberty to deny the truth of it, and there leave the queſtion, as fair on one ſide as the other; for I cannot prove

a nega-

a negative.—If, however, the laws of quarantine have produced the effect alleged, it is very ſtrange that the plague did not diſappear at a much earlier period.

The inſtitution of health laws was as early as 1484, and it appears they were firſt introduced at Venice. If theſe laws have ever prevented an epidemic plague, it is very ſtrange that they were ineffectual in Venice, and other parts of Italy, for near two hundred years, as they certainly were. It is indeed wonderful that, during the ſixteenth century, when all Europe was almoſt continually ravaged by that diſeaſe, and down to the cloſe of the laſt century, no man could be found to deviſe a law, and no police to enforce it, ſo as to arreſt the progreſs of the plague in Italy. Yet ſuch was the fact.

The firſt ſtatute I believe in England to reſtrain the progreſs of infection, was in 1604, in the firſt ſeſſion of James I. 31. The regulations attempted by the proclamation of Queen Elizabeth in 1580, before recited, prohibiting the enlargement of London, and the reſidence of more families than one in the ſame houſe, could not, from the tenor of them, be carried into effect. The ſtatute of James limits its proviſions to the confinement of the ſick to their houſes, a breach of which was made felony. An enforcement was attempted in the ſubſequent plagues, and eſpecially in 1665, but without the leaſt good effect,

as to the city at large, and with a very ill effect upon the diseased and their families. It is certain, however, that a strict execution of such a law, would arrest the progress of *infection*; for the infection of the plague is found, and admitted on all hands, to be confined to contact, or very near approach, so as to be received by the breath of the diseased. If, therefore, the disease was propagated by infection only, such confinement of the sick would check its progress, if not annihilate it. We know by repeated experience in America, that there is not the least difficulty in putting an end to a disease of specific contagion; and it has often been done in cases of the small-pox. Hence, the inefficacy of the law of James I. after repeated trials in the plague, is a strong evidence that its propagation depends on some other cause than infection.

From 1604, to the reign of Queen Anne, no general laws were enacted on this subject, as far as I can discover from the printed statutes. In the ninth year of Queen Anne, 1709, passed the first statute enjoining vessels to perform quarantine; at least I can find none earlier. This was repealed by 26th George II. 1752, a new statute on the subject, which was afterwards amended by the 29th of the same reign.—Now it so happens, that the plague ceased in London in 1666, forty-three years *before* a general quarantine was instituted. Particular laws had been passed before,

on

on emergencies, as in 1664, when all importation of goods from Holland was prohibited, on account of the plague then in Holland, but without effect. The truth then is, so far as regards Great Britain, now the most commercial country on earth, and at the time in question, the most commercial, next to Holland, the plague entirely ceased and disappeared, forty-three years before the existence of quarantine laws. If any mistake occurs in this statement, it must proceed from want of materials—my enquiries are limited to Blackstone, and the printed statutes at large, the only documents I possess on that subject.

In the course of my reading, I have found but two or three instances, in which it has even been *supposed* that health laws have preserved a city from pestilence. Mead mentions two instances; one at Ferrara, in 1630, when every person, seized with the disorder, was immediately removed to a lazaretto, which being done in seven or eight instances, the disease was checked and disappeared.

Another instance he mentions was at Rome, in 1657, where the persons first seized were removed to lazarettos, and their families to hospitals, without the city, and the city was soon freed from the disorder. He supposes further, that the disease was suspended a whole fortnight in Marseilles, in 1720, by the same means.

 I have

I have no account before me of the origin and progreſs of the plague in Italy, in 1630 and 1657, except the ſketches found in Mead's works; but wherever I can obtain a correct account of this diſeaſe, mentioned alſo by Mead, I find his ſtatements are imperfect and erroneous; I therefore place very little dependance on them. That the plague in Marſeilles was ſtopped a fortnight by regulations of policy, is not true. The diſeaſe appeared in the preceding autumn, and was ſuſpended five or ſix months by the winter. When it appeared in the month of May, 1720, writers ſay the firſt caſes were among thoſe who had intercourſe with the ſhip and goods from Said; but all thoſe goods were prohibited to be carried into the city, and ſubjected to fifteen days retreat and purification. The porters who had concern with them were confined. Some weeks after, in the month of June, caſes of the diſeaſe appeared in the city; all precautions had proved uſeleſs; as the hot weather came on, the diſeaſe ſtarted up here and there in the city, among perſons who never had any concern with the ſhip or the goods, or the infected; it then ſubſided, then again appeared, in the manner before related.

Whether the perſons ſeized in May contracted the diſeaſe from the goods, or foul air of the ſhip, or not, is not material; for the goods were cleanſed, and all the diſeaſed confined to the hoſpital, and all the porters ſhut out from the city.

city. Yet when the diſeaſe appeared in the city, no perſon could tell how it came there; many were ſeized who had never been near infection; and hence the populace reſort to ſuppoſition to account for its origin. They *ſuppoſe* the diſeaſe had come from the goods after they were cleanſed, though they had no evidence of it. Beſides, I have before remarked under the year 1720, that the goods could not be infected, for it is admitted on all hands, that they were ſhipped at Said, when the diſeaſe was *not* in that port.—The ſhip's hold might have generated foul air on her paſſage, and the firſt perſon connected with her might have contracted a peſtilence from that air, which is not an uncommon thing in ſuch a very ſickly period as that was, when mortality was increaſed all over Europe and America. But the truth is, had that air been the cauſe of the plague in the city, the diſeaſe would not have been ſuſpended for ſix weeks, but would have made a regular progreſs from one patient to another. But no; it diſappears for ſix weeks, and then breaks out in parts of the city remote from the ſuppoſed ſource of infection, and among people who had not been near that ſource. So inaccurate and inconſiſtent appear all accounts of the contraction of epidemic diſeaſes from fomites, which I have been able to inveſtigate by full and authentic documents. This ſhows how little reliance we can place on partial ſtatements, made

to support favourite systems.—I therefore am persuaded that the cases mentioned by Mead of the effectual restraint of the plague in Italy, by removing the sick, are not fully stated, or that an accurate inquiry would prove the supposed effect to result from other causes.

The following facts will furnish a more rational solution of the phenomenon.

In the United States, ever since the commencement of the present constitution of air, that is, from 1790, sporadic cases of our pestilential fever have occurred, not only in cities, but in various parts of the country, more or less, every summer and autumn. In 1792, occurred a number in New York; also in 1794, when one case exhibited infection; and in 1797. Of about thirty cases perhaps, in each year, some of them were excessively violent, highly marked, and in a degree infectious. In 1791, and in 1796, several hundred cases appeared, yet the disease was not epidemic, but local; and the business of the city was not suspended. Now had every person, the moment of his seizure, been conveyed out of the city to a hospital, the escape of the city in each of these years, would vulgarly have been ascribed to that circumstance. This was doubtless the case in Ferrara and Rome, and this is unquestionably the solution of the fact, that the cases in the Italian cities were sporadic cases, which always occur in the neighbourhood of the plague. This disease,

diſeaſe, in the years mentioned, raged in other parts of Italy; the caſes mentioned by Mead were ſporadic caſes, indicating a peſtilential conſtitution of air extending to thoſe cities, but of a leſs malignancy, and too mild to produce a general peſtilence in thoſe places; it infected only a few perſons of habits moſt ſuſceptible of it; and to theſe it probably would have been limited, had none of them been removed.

A ſimilar fact occurred in Philadelphia in 1794. Eighty or a hundred perſons died that year of the true yellow fever; none of them were removed; but to theſe was limited the operation of the peſtilential principles, local and general; and no epidemic enſued.

In New-London a caſe occurred in 1795; and in 1796 ſeveral caſes of the ſame diſeaſe; but no epidemic, although no removal of the ſick took place.

In Providence ſporadic caſes have occurred almoſt every year with decided ſymptoms of the infectious yellow fever. In 1791, in June, died two daughters of a widow in the centre of the town. They vomited bilious matter, and their bodies were yellow with livid and purple ſpots. Other caſes occurred the ſame year; one caſe in 1792, and a number in 1793, 4 and 5; caſes which could not poſſibly have originated from foreign ſources. Some of them appeared to be infectious, as that of the young women firſt men-

 tioned,

tioned, the firſt being taken on the 4th of June, and dying on the 7th; the ſecond being ſeized on the 9th, and dying on the 12th. Yet no epidemic followed; and had theſe patients been removed to a diſtant hoſpital, the ſafety of the town would have been aſcribed to that removal; and the ſalutary effects of health laws, would, by Mead's followers, have been trumpeted over the country; and what is worſe, would have been recorded as an important fact, which would hereafter miſlead poſterity.

Nothing is more dangerous than to build a theory, or to eſtabliſh a general principle on a few detached facts inaccurately ſtated, and ill-underſtood.

With regard to the caſe of Rome ſtated by Mead, it muſt be obſerved, that the diſeaſe had, in the preceding year, killed 10,000 of its inhabitants; and in the kingdom of Naples 400,000. The diſeaſe had probably finiſhed its courſe in that region; and the few caſes in Rome in 1657 were only detached inſtances, the remains of the peſtilential cauſe, ſuch as occurred in London in 1666, after the fatal plague of the preceding year. It is by no means probable that the diſeaſe, if neglected, would have become epidemic.

But we have ſtronger ground to oppoſe the idea of the College of Phyſicians, relative to the effect of health laws. Numerous examples are on record, in which the full force of the beſt

regulations to prevent peſtilence has been applied in vain; and ſince the publication of the College, from which this idea is taken, Philadelphia has witneſſed the futility of ſuch regulations.

In 1636, the law to prevent infection was rigorouſly executed in London; the ſick were confined; ſuſpected families were ſequeſtered; but all to no purpoſe; the diſeaſe ſpread; the legal reſtrictions were then taken off, and no ill-effect followed; the diſtemper ſpread no faſter than before.

In 1665 the ſame regulations were tried in vain; and ſo was the law, prohibiting the importation of goods from Holland.

The approach of peſtilence towards Dantzick in 1708, in which year it appeared at Thorn, alarmed the magiſtrates of the former city, and every poſſible precaution was uſed to prevent its reaching Dantzick. Commerce and communication with infected and ſuſpected places were forbidden; no ſorts of merchandize, eſpecially thoſe which are moſt apt to retain infection, were permitted to enter the city from ſuch infected places; all ſtrangers and travellers were ſtrictly examined, and none ſuffered to enter the city without ſufficient proof of coming from healthy places; all the inhabitants were cautioned not to hold correſpondence with infected places, nor to harbour thoſe who came from them.

Theſe

Theſe and other regulations were enjoined by an edict in July 1708. Yet all to no purpoſe; the plague appeared at Dantzick the next ſpring.

Baddam's Memoirs, vol. vi. p. 6.

This is a remarkable inſtance of the futility of human regulations when oppoſed to the laws of the phyſical world. The people of Dantzick, had they been acquainted with the principles of peſtilence, might have foreſeen in 1708 the probability of the inefficacy of their regulations. The ſtate of the air in the production of millions of ſpiders, and the increaſing mortality in the city, indicated the exiſtence of a ſtate of the air unfriendly to health, which was increaſing, and only required a little more virulence to generate the evil, which they ignorantly ſuppoſed muſt come in ſick bodies, goods or old clothes; and which they were idly combating on that miſtaken principle.

It has already been ſtated, that the rigorous execution of health laws at Marſeilles in 1720 proved utterly fruitleſs.

The plague which deſolated Naples in 1656, was ſaid to be introduced into that city by ſoldiers from Sardinia, where it raged the preceding year. Yet the Viceroy, Count Caſtullo, had prohibited all intercourſe with Sardinia. After the diſeaſe appeared, which was firſt in the form of a malignant fever without glandular tumours, all poſſible

poſſible means were uſed to prevent its ſpreading, but to no purpoſe.

The confidence in modern health laws is like the reſpect which the ancient Egyptians paid to the bird Ibis, which they ſuppoſed averted the plague by deſtroying the flying ſerpents that the hot Lybian winds brought into the country.

Cicero, de Nat. Deor. lib. i. 36.

The Egyptians were like all modern nations; unwilling to believe the plague generated at home, they aſcribed it to infection brought by flying ſerpents, as the moderns aſcribed it to old clothes, bales of goods, and infected ſhips. They miſtook the cauſe, adored Ibis as the moderns do quarantine, and with the ſame ill-ſucceſs.

But we need not ſtep off of our own territories to find evidence of the inefficacy of health laws, when oppoſed to the operation of the laws of nature. No expedient has been left untried to ward off the calamity of peſtilence, but without any viſible effect. The ſeverity of the affliction in Philadelphia in former years, had rendered the magiſtracy of the city extremely careful to guard againſt importation in 1798. The moſt rigid quarantine was exacted—ventilators of the beſt conſtruction employed—the veſſels were waſhed, fumigated, white-waſhed with lime, and every practicable mode of purification adopted. Not a veſſel

a veſſel was ſuffered to approach the city without ſatisfactory evidence of the healthy ſtate of the people, and the ſalubrity of the veſſel and cargo.

See the letter from Hillary Baker, Eſq. Mayor of the City, to the Mayor of Baltimore, dated Auguſt 13, 1798.

Alas! all to no purpoſe! The ravages of the diſeaſe are well known.

If, ſays the late worthy Mayor, the diſeaſe has eluded the health officers, I ſhall deſpair of future ſucceſs, unleſs the Weſt India commerce ſhall be prohibited during the ſummer months, and magazines eſtabliſhed below for receiving the cargoes.

Similar proviſions in other ports have been eſtabliſhed with no better ſucceſs. The health laws of New York, ſo far as appears, were as well executed in 1795, 96 and 98, when the fever was epidemic, as in 1794 and 7, when it was not. No viſible good effects are to be diſcovered in guarding againſt an epidemic; the utility of cleanſing veſſels therefore is limited to guarding againſt the operation of infection upon a few perſons who may enter them with foul air on board. Public health, ſo far as can be diſcovered, has never been ſecured by thoſe regulations. What ſeems to place this point beyond queſtion, is, that for thirty years preceding 1792, no peſtilential fever ever ſpread in America, from the 10,000 infected ſeamen and paſſengers which arrived in the coun-

try

try from the West Indies, and during which time, in most places, not the least precaution was ever used to guard against it; yet since 1792, that is, under a state of air generating various epidemics, the pestilential fever has appeared in sporadic cases every year, and in almost every town in America; and has raged as an epidemic in most of our large towns in opposition to the utmost efforts of human skill. I am persuaded, the conclusions from these facts amount to a demonstrative evidence, that infection is *not* the principal, or cause *sine qua non*, of this terrible calamity.

The application of quarantine laws to our epidemic pestilential fever, is just as useless as the order of the Sultan, Achmet I. in the wasting plague of 1613, for transporting all the cats in Constantinople to the island of Scutari. The Jewish physicians told the Emperor, that the plague was occasioned by the cats; and the poor cats were dispatched into exile. Yet this did not restrain the plague.

People have for ever been mistaking the cause of the plague. In the first centuries of the Christian æra, when disputes ran high between Christians and Pagans, these sects mutually charged the plague each to the other. In 1340 the Germans ascribed the plague to the Jews, and massacred great numbers of that race. In Paris, during a plague, many protestant *heretics* were

were facrificed for bringing the calamity upon that city; and a propofition has been made in America to ftop all intercourfe with the Weft Indies and the Mediterranean during the fummer months! Aftonifhing blindnefs!

But, it will be afked, fhall we have no health laws? I anfwer, by all means. Their utility is obvious on many occafions. Thus, when an infected fleet arrives in a port, the town is in eminent danger, of what may be called a jail fever on a great fcale. The quantity and virulence of infection thus imported, have produced deftructive confequences, as at Breft in 1757, where were landed in November, and placed in hofpitals, about 5,000 difeafed feamen and troops from fhips, moftly out of De la Motte's fleet, from Louifburg, with a malignant fever on board. The effect was, that 10,000 men died in the hofpitals the fucceeding winter, and many of the inhabitants of Breft. But it will be remarked, that this infectious difeafe did not become an *epidemic* in Breft; it fpread only by infection; and as foon as that was diffipated, the difeafe difappeared. It raged in winter, and fubfided in fpring. This is an important diftinction always to be obferved by thofe who guard the public health; an epidemic peftilence begins when the feafon or ftate of air favours it, and rages without control againft all human efforts; the common

mon air becomes tainted, ſo as to produce the diſeaſe without the infecting principle from bodies or clothes; and the diſeaſes ſubſide only at the command of the ſeaſons and the elements. Againſt ſuch no legal proviſions are, or can be of any avail; and ſuch is uſually the yellow fever of our country.

But diſeaſes propagated only by infection, like the jail and ſhip fever, never put on the form of an epidemic. They rage in crowded priſons and ſhips where they are generated; and when multitudes are crowded into hoſpitals, they carry the evil with them; and all perſons coming within reach of the infection, are liable to ſuffer. In this manner Breſt loſt many of her inhabitants; a town in America is ſaid to have done the ſame, from the yellow fever imported in Sir Francis Wheeler's fleet, as already related. But in ſuch caſes, the infecting diſeaſe requires contact or near approach to aid its propagation; and does not aſſume the complexion of an epidemic. The two ſpecies of diſeaſe are as diſtinguiſhable as light from darkneſs.

Thus at the black aſſizes in Oxford in 1577, a malignant or jail fever of a ſingular kind was produced ſuddenly; almoſt all the court and ſpectators were ſeized: many died; but no epidemic followed in Oxford: and in this inſtance, the effect was ſo ſudden, that the human body did not generate infection.

So alſo at the Old Bailey, not many years paſt, a few priſoners entering the court from a dirty jail, without changing their dreſs, infected a large number of perſons who died; but no epidemic followed—the infection was ſoon diſſipated, and there was an end of the diſeaſe.

With our peſtilential fever this is not the caſe, nor with any epidemic plague that ever exiſted. Remove the ſick, cleanſe the houſes and clothes, do whatever human art and labour is competent to effect, all will not avail—caſes ſpring up in every quarter, and the diſeaſe takes its courſe.

So it was in Candia in 1592, as related from Thuanus, under that year. As ſoon as the plague appeared, all the ſick and all the ſuſpected were removed from the city; but to no purpoſe; it raged till July—then abated without any human means, and revived again in October.

Thus ſays the author of Traité de la peſte, "Univerſal cleanſings have proved uſeleſs; the plague has ravaged places after every precaution; and after negligence, it has entirely ceaſed, as in Naples."

Such are the facts; and hence the neceſſity of diſtinguiſhing carefully between *epidemic* peſtilence, proceeding principally from general cauſes in the elements, and marked by other epidemic diſeaſes, by the failure of vegetable productions, and by the ſickneſs or death of cattle, fiſh, and other animals—and *diſeaſes merely infectious*, generated

generated by artificial means, which *may* be communicated, which may happen in jails, ſhips, and camps, in the healthieſt ſtate of the elements, and which ceaſe as ſoon as the infection can be diſſipated by purifications and freſh air. Without this diſtinction, the merit of legiſlative and police regulations can never be duly appreciated. Such regulations applied to *epidemics*, as they continually are, prove totally futile—applied to diſeaſes of mere infection and of ſpecific contagion, as jail fever and ſmall-pox, they may be, and often are, the means of preſerving multitudes of lives.

It is important, therefore, that health laws ſhould be judiciouſly framed and ſtrictly executed, becauſe there *may* be caſes in which public health will be preſerved by them; although they never can reach the cauſe, or prevent the ravages of *epidemics* which originate where they exiſt.

With reſpect to merchant-men, health laws may alſo be of ſome uſe, in preſerving the lives of ſeamen and of perſons concerned in the veſſels. Sick men may generate a ſmall degree of infection; but on board of merchant-men, the number of ſeamen is too ſmall to infect a ſhip, ſo as to endanger public health, unleſs ſhamefully neglected.

The moſt danger from merchant-men is from the foul air generated, on long voyages and in hot ſeaſons, from periſhable and fermenting ſubſtances. From ſuch vitiated air, deprived of its

 vital

vital principle, great danger may arife to the perfons who firft open and enter the holds; and perhaps to a neighbourhood. It is of great confequence, therefore, to ufe ventilators freely on board of veffels freighted with perifhable articles; and to have them effectually cleanfed, before they are fuffered to approach our wharfs.

But I am not convinced that the air of fuch veffels ever yet *originated* an epidemic fever. It appears to me, that the Academy of Medicine in Philadelphia lay more ftrefs on this caufe than it deferves. The fphere of the operation of fuch a fmall morbid caufe cannot be extenfive; and all the foul air of the largeft veffel muft be fo attenuated by diffufion as not to produce deleterious effects at any great diftance. It may be injurious to a fmall neighbourhood; but I do not conceive it poffible, that the noxious air of a few fquare yards can impregnate the whole atmofphere of a city; and as to infection from the fick, I have repeatedly proved, that this can never produce an epidemic. I will admit the *bare poffibility*, that imported infection may enkindle the flame of peftilence in a place fitted for it by local caufes, where no peftilence would appear without a fpark from infection. This is as much as I can admit to be poffible, and more than I believe, after a more minute and careful inveftigation of facts, probably, than was ever before made in America. Moft of the cafes I can find, where accurate accounts

counts are preserved, of supposed importation or communication of autumnal diseases, fail utterly of proofs to support common opinion; and many of them are incontrovertibly proved to have had their origin in the places where they have existed.

It is easy, I aver, to distinguish in every case the nature of pestilence; that is, whether it is an epidemic proceeding from a state of the elements, or a disease generated solely by foul air, artificially collected. In a few weeks, if not a few days, a disease will show whether it proceeds from infection only, or from a general elemental source; and when it appears to proceed from the elements, men may just as well attempt to save the cats, the wild animals, or the fish in the ocean, from the effects of that principle, as their own species, by laws enjoining quarantine and purification of ships. The same cause that destroys the cats or the fish in one case, destroys human life in the other; and that cause exists in the elements; it is at home; quarantine laws do not reach it.

An epidemic disease may be distinguished from a disease proceeding from infection or specific contagion by the following circumstances:

1st. An epidemic pestilence is usually preceded by influenza, affections of the throat, or acute and malignant fevers.

2d. An epidemic predominates over other diseases; totally absorbing them, or compelling

 them

them to aſſume its characteriſtic ſymptoms. This laſt circumſtance is deciſive of the character of the diſeaſe.

A diſeaſe propagated by contagion or infection only is not thus diſtinguiſhed. It has no precurſors, it extends and ſpreads only by contact or near approach; and has no effect on the diſeaſes in its vicinity. The ſmall-pox or jail fever, depending on mere infection, never expel a dyſentery or intermitting fever.

In every poſſible caſe, a plague that baniſhes other diſeaſes, as I believe it always does, is an epidemic, generated in the place where it exiſts; for it is not poſſible that this expulſion of other diſeaſes could take place, unleſs the epidemic depended ſolely on the elements. Simple infection would not change the ſymptoms of another diſeaſe, even in the next houſe, much leſs in all parts of a city.

To ſhow how little an epidemic depends on infection, let us advert to facts. In all the Eaſtern countries, the plague is ſuffered to take its own courſe without reſtraint. There are no regulations to controul its progreſs, or prevent its return. Its beginning is uſually gradual; a few die the firſt year; the proper ſeaſon ſuſpends its progreſs; the next year it is more general, and often the third year is the moſt fatal.

It is remarkable, that after its moſt extenſive effects it abates and ſuddenly diſappears. In London,

London, the malignant precurſors of the plague of 1665 appeared as early as 1661, but no ſooner had its criſis paſſed, than in a few months it was totally extinguiſhed. The ſame happened at Aleppo in 1762, and ſuch is uſually the fact.

Let any man ſuppoſe the diſeaſe to be propagated wholly or moſtly by infection, and attend to the conſequences. In Aleppo, ſays Ruſſel, died 500 in 1760, in 1761 died 7000, and in 1762, 11,000. On the principle of infection, then, ſome ſick man or a bundle of clothes firſt ſpreads the diſeaſe, ſo as to deſtroy 500 lives; the infection of 500 deſtroys 7000 lives; the infection of 7000 deſtroys 11,000 lives; and the next year the infection of 11,000 deſtroys—none at all!

In London a few bales of cotton, ſmuggled into the city from Holland in 1664, communicated infection that deſtroyed 68,000 lives; the infection from this immenſe number proves fatal —the next year to 1900 only; and theſe, the year following, infect only 35!—If infection has much concern in propagating that diſeaſe, its operation certainly defeats all arithmetical calculation of its phyſical powers!

The whole theory of infection, to which Mead has given ſo much celebrity, and which is maintained by many phyſicians in this country, is abſurd and ridiculous from firſt to laſt; leading legiſlators, magiſtrates, and citizens, aſtray from the truth, producing moſt ſerious inconveniences

to commerce, and preventing the adoption of the only means of mitigating the peſtilence to which our cities are expoſed.

In Turkey and Egypt no pains are taken to cleanſe houſes or clothes after a plague. No ſooner has a great plague ceaſed, which has cut off 300,000 people in Conſtantinople or Cairo, than the infected houſes are filled by other people, who replace the dead, uſe the furniture and the bedding on which the infected had died; or the old clothes are ſent to auction, and purchaſed by Jews, who retail them out for uſe, uncleanſed; and yet, amidſt all this maſs of concentrated infection, no perſon has the plague: or, if a ſporadic caſe occurs here and there, no epidemic enſues for two, three, or four years, perhaps longer; then all at once, when the infection muſt neceſſarily be deſtroyed by the action of air and water, the diſeaſe breaks out again, and becomes epidemic. Then ſome arrival from an infected place is hunted out, and the calamity is charged to the account of ſome poor ſeaman, or his clothes! The infection of half a million of people produces no plague in one year; but in another, the inviſible fomes of a piece of cloth, or the breath of a ſingle man, is ſufficient to ſpread deſolation over a great city, or a kingdom *!

Such

* Hodges informs us, that, after the plague in London, in 1665, people returned into houſes not cleanſed, and even ſlept in beds on which the infected had died, without fear or injury.

Such are the abſurdities of the modern notions about the plague, which adorn this ſplendid æra of philoſophy and ſcience!

Of the nature of the infecting principle in diſeaſes, we know very little; and even its effects are not always comprehenſible. We obſerve a difference alſo in the operation of the principle which we cannot explain. Why the ſmall-pox ſhould be communicated under *all* circumſtances, the plague only under certain circumſtances, is a myſtery not yet unfolded. It is ſuppoſed, that the diſeaſed body diſcharges certain fine poiſonous particles, which are ſuſpended and diffuſed in the air, and being imbibed by the pores of the ſkin, and with the breath, excite the ſame ſpecies of diſtemper in a healthy body. Theſe effluvia generally eſcape our ſight, and very often our other ſenſes; but they may be concentrated in ſuch quantities as to be very obnoxious to the olfactory organs, and even to excite ſudden nauſea in the ſtomach.

But why the effluvia from the ſmall-pox, anginas, and the meaſles, ſhould be independent of heat and cold; and thoſe of dyſentery, plague, and other typhus fevers, ſubject to be excited

injury. This is not at all ſtrange. Unleſs the effluvia from the ſick have been cloſely confined, and are greatly condenſed, they will not affect a well perſon; and indeed it is a difficult thing to preſerve the morbid matter in ſufficient quantity to communicate diſeaſe in cold weather.

into action by the one, and to be deftroyed by the other, is a phenomenon never yet explained. We may fay, the particles iffuing from the former clafs are more fubtle, volatile, and penetrating; but this is all conjecture. Certain it is, that the poifon of fmall-pox, angina, and meafles, is of a more diftinct, fpecific kind, than that of the plague, lefs connected in its operation with putrid exhalations from other bodies, and lefs fufceptible of grades in its powers.

So far as I am able to comprehend the nature of the infection of plague, and other autumnal difeafes, paffing under the popular name of putrid, it appears to confift of a fpecies of air, which is one of the elementary parts of all vegetable and animal fubftances. It may be what Doctor Mitchel denominates the feptic acid; that fluid which is difcharged from flefh in the procefs of putrefaction. It may be fome other fpecies; but it is very evident, from all its effects, that it operates in producing difeafe no more than all the morbid exhalations extricated from every fpecies of vegetable and animal fubftances in the putrefactive procefs. In all or moft of fuch fubftances there is, it is well known, a fpecies of air, or acid matter, which, when in a form detached from other fubftances, is highly noxious to health. To this fluid, or feptic acid, evolved from vegetables in a ftate of natural putrefaction, and floating

floating in an aërial form, is afcribed the whole clafs of bilious fevers, which prevail near marfhes.

Hence the effluvia from a perfon labouring under the plague are fufceptible of all degrees of concentration, and in proportion to their concentration will be their violence and certainty of effect, when they attach themfelves to a healthy body. In this refpect the infection of the plague differs from that of the fmall pox. The matter of contagion in the fmall-pox, however fmall, is fufficient to communicate the difeafe; and it is cuftomary for phyficians to wipe clean the point of a lancet, dipped in variolous matter, before it is inferted in the fkin, for the purpofe of inoculation. It is alfo proved by experiment that the quantity of infection introduced by inoculation, whether more or lefs, makes no material difference in the number of puftules, or violence of the difeafe.

But in the plague, the operation of infection is very different. This difeafe, if light, produces no infection, or very little—more violent cafes appear to be more apt to be communicated—and in great plagues the infection is vifibly augmented. Yet in moft peftilences an inftantaneous expofure to the effluvia from the fick will rarely produce any effect, as in the cafe of fmall-pox and meafles. It ufually requires that a perfon fhould be a confiderable time in the room with the fick, in the plague, to receive poifonous air fufficient to ex-

cite diſeaſe; and more generally it is not communicated without handling the ſick, or imbibing his breath. In many caſes all this expoſure for weeks and months together will excite no diſeaſe. Hence Ruſſel repreſents the plague as of different degrees of malignity, and not always infectious. Hence the propriety of cloſe and indefatigable attention, in peſtilence, to every article of cleanlineſs; for by this means the quantity of infection is reduced, and the danger diminiſhed, from a high degree down to nothing. Not ſo in ſmall-pox and meaſles, the contagion of which regards not filth or cleanlineſs.

The infection of the plague, dyſentery, and the like, ſeems therefore to be nothing more than *an acceſs of noxious matter to the local cauſes, morbid exhalations.* The noxious air of filthy ſtreets, docks and tenements, are ſecondary and augmenting cauſes of the plague; when the diſeaſe appears, the effluvia from the diſeaſed ſtill *augment* theſe other local cauſes. Thus when a certain ſtate of air, in a city, generally will produce a malignant fever, and perſons are expoſed to it by walking in the ſtreets, a ſick perſon, confined in a cloſe room, will ſoon fill that room with exhalations from his lungs and pores, which will render that room more dangerous to a perſon in health than the open ſtreet. This ſeems to be the amount of the infection of plague and other autumnal diſeaſes.

Thus

Thus alſo, in a violent plague, the common air of the ſtreets becomes ſo highly infected, that perſons attending the ſick cannot poſſibly determine whether they take the diſeaſe from the common atmoſphere, or from their intercourſe with infected perſons. The only caſes which afford certainty in this reſpect are, when the diſeaſed are removed into the pure air of the country, and nurſes and viſitors, who have breathed no peſtilential air in the city, are taken ill in a few days after ſuch intercourſe with the ſick. Theſe would be clearly the produce of infection. But theſe caſes rarely occur. It has already been obſerved, that the worſt caſes of peſtilence removed into the country ſeldom infect the attendants. This ſhows how little apprehenſion ought to be excited by mere infection, and how ill founded are the alarms in the country, about the ſpreading of the yellow fever; alarms that often occaſion a neglect of diſeaſed fugitives from the city. People in the country have little to fear from infection, if the ſick are kept in airy rooms and cleanly; they ought not to abandon the ſick; for the duties of humanity are not incompatible with their ſafety. It is the infected ground, if I may ſo call it, the local atmoſphere of peſtilence, which is to be dreaded, and eſpecially by ſtrangers. During its prevalence in a city or town, the air of the place is rank poiſon to perſons accuſtomed to good air.

The preceding facts and diſtinctions enable us to form a juſt eſtimate of the importance of Health Laws. In nine caſes of ten, in which quarantine is enjoined, human efforts are oppoſed to the great laws of nature, and are therefore uſeleſs. In all caſes where the air of a country exhibits evidences of a peſtilential conſtitution, in an increaſe of the number and violence of the ſymptoms of common diſeaſes; in the production of certain epidemics, as catarrh, anginas, meaſles, petechial fevers, and the like; in the death of fiſh, or the unuſual diſeaſes of cattle and other animals; in the production of inſects, uncommon in ſize, in kind, or numbers, and other remarkable phenomena, before mentioned; in all ſuch caſes, the peſtilence which invades man will be found to ariſe ſolely from the uncontroulable laws of the elements; and quarantine will be utterly unavailing to guard cities againſt its introduction and ravages. The remedy is not applied to the ſource of the diſeaſe. Hence the efforts of the police in London in the laſt century, and of Dantzick and Marſeilles in this, were entirely uſeleſs; and hence the failure of all health laws to ſave our cities from the late epidemics.

Satisfied as I am of this truth, I would not lay aſide the application of theſe laws. The bare poſſibility of ſaving the lives of a few individuals, and eſpecially of diſeaſed ſeamen, is a good reaſon for cleanſing ſhips after long voyages, and of purify-

purifying their cargoes when in a bad ſtate. But what I contend for, is, that we muſt not expect the beſt health laws, moſt rigorouſly executed, will ever be ſucceſsful in guarding cities againſt *epidemic* peſtilence. In our reliance on ſuch regulations we expoſe ourſelves to perpetual diſappointment; we expoſe the lives of citizens; we overlook the true cauſes of the evil, and neglect the only means of preventing or mitigating its effects.

Further, the opinion of the ſpecific contagion of the plague has originated many, not only uſeleſs, but barbarous regulations. Such is the practice of confining the citizens of an infected town within its limits by an armed force—which I am informed has been done in Europe. In Marſeilles the firſt perſons ſeized were confined to their houſes by the point of the bayonet.

An ignorance of the nature of a diſeaſe and its degree of danger may be pardonable in a prince or the legiſlators of a free ſtate: but there is a point, beyond which ignorance in medical profeſſors becomes a crime. No ſcience is neceſſary, however, to convince any man, that moſt peſtilences proceed only from the deranged ſtate of the elements, aided by the morbid exhalations of cities. This is a fact that may be known to a certainty by very little reading and obſervation. It was well known in paſt ages, when men were more governed by obſervation than by theories and erroneous reaſon-

ing.

ing. Mead's attempts to prove the ſpecific contagion of plague, aided by his popularity, had a moſt ſurpriſing ſucceſs; his treatiſe was received as a ſtandard of truth; it every where ſuſpended enquiries, and checked a ſpirit of inveſtigation, which might have diſſipated error; it was the baſis of the preſent laws of quarantine, which are applied, in thouſands of caſes, where they are as improper, and as little wanted, as if applied to prevent an epidemic pleuriſy, or a head-ach, embarraſſing commerce without the ſhadow of neceſſity. But theſe are not the worſt effects. The erroneous ſyſtem of ſpecific contagion has miſled mankind into a fatal ſecurity on the ſubject of the local cauſes of diſeaſes. Suppoſing the laws competent to guard public health, men have not attended to the beſt modes of conſtructing houſes and cities, and to the means of watering and cleanſing them—means by which all the ſlighter peſtilences might be avoided, and the more ſevere ones greatly mitigated. Hence I am perſuaded that the received theory of ſpecific contagion is the direct cauſe of moſt of the fatal plagues that now ſcourge civilized Europe and America: for it will be obſerved that peſtilence has always been the *peculiar curſe* of *populous cities*. Of about two hundred general plagues, recorded in hiſtory, a few only have been ſo violent as to ſpread over countries, into villages and farm-houſes; almoſt all have been limited to large towns,

towns, evidently demonſtrating that they would never have affected mankind, without the influence of the impure air generated in thoſe places. This is a truth as unqueſtionable as it is important ; and on a conviction of this hangs the ſafety of men from that dreadful calamity. Had Mead, and other eminent phyſicians, taken the ſame pains to lead mankind into truth, as into error, we ſhould long ago have introduced improvements into the arrangement and ſtructure of our cities, which would have ſecured our citizens from nine tenths of the infectious diſeaſes by which they have been alarmed and diſtreſſed.

At the ſame time, had men underſtood the common operation of infection, which may be made obvious to the moſt ordinary minds, merchants would not, at this day, have been haraſſed with the neceſſity of performing quarantine, to guard againſt *epidemic* diſeaſes. We ſhould not have ſeen a ſhip from the Weſt Indies condemned to the flames, in a Britiſh port, becauſe ſhe had loſt her crew by the yellow fever ; nor merchantmen from an American port obliged to ride quarantine in the Britiſh channel, becauſe that diſeaſe prevails in this county. Phyſicians, had they not been blinded by ſyſtem, and taken opinions for granted without enquiry into the grounds on which they reſt, would have known before this, that the yellow fever will not ſpread in England, Scotland or Ireland. It never ſhows itſelf in

America,

America, without a much greater degree of heat than the ordinary ſummer temperature of thoſe countries. The heat in thoſe latitudes rarely exceeds, for a few hours in a ſingle day, ſeventy-five, or, at moſt, ſeventy-eight degrees by Farenheit. But no epidemic yellow fever is ever generated in our climate with that degree of heat. In general, we never ſee caſes of that diſeaſe in America until we have had a period of heat riſing, for a conſiderable time, to 85 degrees or higher. In any ſeaſon of ordinary temperature, the yellow fever in the Britiſh kingdoms, and other parallels of latitude, introduced from abroad by ſeamen or others from warmer climates, would immediately ſubſide, and be extinguiſhed without any human efforts. The caſes of malignant fever in England which turn the body yellow, and which ſometimes occur, as mentioned by Lind, are generated about marſhes, in hoſpitals, camps, ſhips, and priſons. An epidemic yellow fever, like that which prevails in America, was never known in England, and probably cannot exiſt in the climate. The quarantine enjoined on veſſels from the Weſt Indies and United States, is utterly uſeleſs in guarding that country from this peſtilence in the form of an epidemic.

It may be ſaid, in anſwer to theſe remarks, that the yellow fever and plague are eſſentially the ſame diſeaſe; the plague has often raged in Great Britain;

Britain; and therefore the climate may not refiſt the yellow fever.

But if the plague has raged in Great Britain, which is admitted, it muſt have ariſen from the unhealthy ſtate of the elements, which may exiſt in any latitude, or from very ſingular ſeaſons, aided by moſt powerful local cauſes, as in London before it was burnt. I ſay the yellow fever will not ſpread in England in the *ordinary* ſtate of the elements, and the *ordinary* temperature of the ſummer. If peſtilence ever invades cool northerly countries, it muſt always proceed principally from diſorders in the elements and ſeaſons. The ordinary cauſes in temperate or cool climates have but little influence in generating peſtilence. Hence in common ſeaſons in England, no plague, bilious or inguinal, could be ſpread, unleſs in a crouded jail, camp, or dirty confined alley in a city. If the phyſicians in England obſerve the general ſtate of health to be good; no epidemics, with unuſual ſymptoms, prevailing; no uncommon numbers of inſects, or diſeaſes among cattle, or other ſymptoms of a morbid ſtate of the elements, it is no more in the power of man to render the plague epidemic in that country, than the pleuriſy or quinſey. I challenge all the faculty in Europe to mention an inſtance in which plague has ever prevailed without ſuch phenomena.

Besides, it seems to be probable, that more heat is necessary to generate and to propagate the bilious, than the glandular plague. My reasons for this opinion are, that the glandular plague appears in spring much earlier than the bilious. It often appears in the northern parts of Europe as early as March, and often in May, when the weather is yet cool. But the bilious plague of our climate has never showed itself in sporadic cases till June, and then very rarely, and only in a few scattered cases of a less malignant type than at a later season. To this remark I have heard of only one exception. Generally, the disease does not appear till we have experienced some days of our hottest weather, and not till the last week in July, except in a few cases as before mentioned. It does not become formidable as an epidemic till the tenth or twentieth of August.

This difference seems to depend on the following circumstances. The glandular plague of Europe, Asia, and Africa, when it breaks out in the northern latitudes, as on the Baltic, or in Great Britain, seems to be more essentially and principally the product of a defective state of the elements, joined to human exhalations in large cities; both which causes are less dependant on heat, than the morbid exhalations of the vegetable world, which seem to give to our American plague

plague its peculiar character, and to be a powerful caufe of the diftemper. I am further confirmed in this opinion by this circumftance. A diftinction between the bilious fevers of our *cities*, and of our *marfhy grounds* on rivers, is obferved to exift in perfect analogy with the foregoing diftinction between our bilious plague and the glandular plague. The mortal fevers about marfhes in the interior of our country are lefs infectious than the peftilential fevers of our cities, although they are at times as fatal, and are characterized by a yellow fkin. Thefe feem then to proceed *wholly* from vegetable exhalations. The fevers of our cities approach nearer to the plague of the Eaft, becaufe they proceed both from *animal and vegetable* exhalations; but the vegetable effluvia have a more predominating influence here than in countries which are dry and better cultivated. Hence the mortal bilious fevers of our interior country evidently form a link in the feries of gradation between the common remittent and the yellow fever of our cities; juft as the yellow fever conftitutes a grade between our river or lake fevers and the Levant plague.

The order of bilious fevers then ftands thus in connection with their caufes.

In healthy Periods.

Common intermittents, remittents, } folely from marfh effluvia.

In Peſtilential Periods, under the operation of elemental cauſes.

Intermittents, remittents,	of a worſe type from marſh effluvia, aided by a general cauſe.
Bilious plague of the country, near lakes and rivers,	ſolely from marſh exhalations with the general cauſe.
Bilious plague of American cities,	from the joint-operation of vegetable and animal effluvia, with the elemental cauſe.
Inguinal plague of the Eaſt,	principally from animal exhalations, with the elemental cauſe.

In this gradation of diſeaſes there is a regular progreſſion of ſymptoms. Intermittents and remittents exhibit a yellow ſkin, more or leſs, but no infection worth naming. The river or lake plague a very yellow ſkin, with morbid ſymptoms, but little infection; the bilious plague of cities, ſometimes a yellow ſkin, ſometimes not; and ſome caſes of glandular tumours, carbuncle, and petechia, with more infection. The Levant plague leſs yellowneſs of the ſkin, and uſually infection and glandular ſwellings. Thus in proportion as the vegetable exhalations predominate in the ſcale of exciting cauſes, there is more yellow-

yellownefs of the fkin, lefs infection, and lefs frequent affections of the glands; in proportion as the animal exhalations abound, as the caufe, the yellownefs declines, and the affections of the glands multiply with augmented infection.

It is a remark of the celebrated Zimmerman, that "exhalations from marfhes do not feem to be fo noxious in cold as in hot countries; yet malignant fevers occur even in Finland. In Germany thefe exhalations produce tertians; in Hungary petechial fevers; in Italy hemitritæa; in Egypt and Ethiopia peftilential fevers."

On Phyfic, p. 131.

It is therefore probable that a greater degree of heat than the ordinary temperature of Great-Britain is neceffary to extricate the fceptic fluids, and give them the virulent poifon neceffary to generate the peftilential fever of our cities. And as no degree of infection ever yet accumulated on board of a merchantman can create a peftilential atmofphere fufficient to generate an epidemic, the fears of the Englifh refpecting fuch veffels from the United States or the Weft Indies are utterly groundlefs. The marfh fevers of England, Scotland, and other cool climates, are of an inferior grade. Such are the autumnal fevers near the fenns of Lincoln, Ely, and Cambridge. In Tarbat in Scotland, a putrid fever fometimes e[illegible]; and after death the body turns yellow; this

this may be aſcribed to certain natural lochs or ponds which ſometimes dry up in ſummer.

Sinclair's Scot. vol. vi. 418, 428.

But theſe diſeaſes, though doubtleſs the ſame in ſpecies, fall greatly ſhort of the violence of our peſtilential yellow fever, which never did, and probably never will, prevail in that climate.

SECTION

SECTION XVII.

Of the Means of preventing or mitigating Peſtilential Diſeaſes.

THE firſt ſtep towards an effectual remedy for an evil, is to aſcertain its nature and cauſe, ſo far as they can be underſtood by effects. Primary cauſes are above the reach of man; proximate cauſes may be ſo far inveſtigated in moſt things, as to anſwer all the purpoſes of mankind.

It has been proved in the preceding pages, and every day's obſervation confirms the fact, that one influential cauſe of epidemic diſeaſes muſt exiſt in the elements, independent of human controul. In the production of epidemic catarrh or influenza, for inſtance, no human or artificial means appear to have any ſhare of influence. In the meaſles artificial cauſes ſometimes modify the ſymptoms, but have no great ſhare in its production or propagation. A ſimilar remark will apply to every ſpecies of angina. The ſmall-pox is alſo modified in its force and ſymptoms by many local circumſtances; and its propagation is chiefly by means of contagion; but this diſeaſe alſo is ſometimes, though rarely,

generated in particular bodies without contagion. The appearance of thofe difeafes in the form of epidemics, excepting the fmall-pox, which may arife from contagion, always indicates a peftilential conftitution of air; and during this conftitution, ordinary or annual difeafes, which depend on feafon or local caufes, affume more violent fymptoms.

Autumnal difeafes of the annual or ordinary kind, though rendered more violent, fatal and extenfive, by a peftilential ftate of air, are, however, generated by fubordinate caufes, moft of which are within the power of man. The dyfentery depends partly on feafon, partly on fituation, as to pure air, and partly perhaps on the imperfection of autumnal fruits. Sometimes it arifes in camps from bad diet, or want of fhelter from the weather; and when it once exifts, is more or lefs propagated by infection.

Bilious fevers of all grades are produced ufually by miafmata or morbid exhalations, from low, damp, marfhy, grounds, where vegetables, in the hot feafon, are in a ftate of rapid putrefaction. Thefe fevers occur annually, and with a violence of fymptoms proportioned to the extent and force of the morbid caufe. The origin and phenomena of all this defcription of difeafes are fo well known, as to render any obfervations of mine unneceffary.

The plague, glandular and bilious, feems to be nearly allied in its fymptoms to the ordinary bilious

bilious remittent. The point ſeems not altogether ſettled, whether the contagious yellow fever, as it is uſually called, and the common ſporadic yellow fever of the Weſt Indies, and the bilious remittent, are different grades of one ſpecies of diſeaſe, or whether they are of a diſtinct ſpecies.

On this point, however, the late epidemics have furniſhed our ſcientific men with proofs that appear to me to decide the queſtion in favour of the identity of the ſpecies. The evidence ariſing from the diſeaſe in Baltimore, is alone ſufficient to decide it, as far as regards the yellow fever and the remitting; and the Academy of Medicine in Philadelphia is a moſt reſpectable authority in favour of the ſame doctrine.

That the glandular plague of the Levant, and the bilious infectious yellow fever of our country are ſpecifically the ſame diſeaſe, I have no doubt; but they take ſome different ſymptoms, either from climate, or other cauſes unknown. The glandular tumours are held, by moſt writers on the plague, to be the characteriſtics of the diſeaſe, which alone decide its nature, and diſtinguiſh it from other malignant fevers. But Diemerbroeck, and all the beſt authors agree, that theſe external ſwellings are not eſſential to the diſeaſe; and that many have the true plague without them. They are, however, the uſual marks of the diſeaſe.

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In our bilious peſtilence theſe ſwellings are leſs common. But, though rare, they ſometimes appear in the moſt unequivocal form of the true peſtis. I ſaw an inſtance in 1796; and they were more common in the laſt epidemic.

The yellowneſs of the ſkin has given name to the peſtilence of our country; yet this is a misfortune, for it may deceive a common obſerver. A yellow ſkin often accompanies lower grades of bilious fevers, not peſtilential; and is by no means eſſential to the infectious yellow fever. In all our late epidemics perſons have died without exhibiting this colour of the ſkin; and it has been leſs common the laſt year than in former years. It appears then, that the lighter the epidemic diſeaſe, the more common the yellowneſs of the ſkin; and *vice verſa*. This is no inconſiderable proof of the identity of the bilious and inguinal plague; that, in proportion as the bilious plague of our climate becomes violent, and approaches the true plague, it loſes that yellow colour of the ſkin, and aſſumes the glandular ſwellings. This, I am informed, is the fact, as obſerved by the Phyſicians in New-York the ſummer paſt. There are, however, ſome differences in the ſymptoms of the two ſpecies of the plague, which it belongs to the faculty to obſerve and define. It may be that the moiſture of our country, not yet cleared of its woods, and abounding with ſwamps and marſhes, may occaſion

ſion the difference in the ſymptoms. The parts of Europe, Aſia and Africa, where the plague moſt uſually prevails, are clear of woods and cultivated. Perhaps an increaſe of population, and human effluvia, with a decreaſe of vegetable exhalations in America from cultivation, may, in time, change the form of our peſtilential fever into the true inguinal plague. I have reaſons for believing ſueh a change actually took place in Rome. Some of the plagues deſcribed by Livy were obviouſly of the bilious kind, ſimilar to our epidemic fever; but in later periods, the plagues in Rome are expreſsly deſcribed to be "*peſtis inguinaria.*"

However this may be, the cauſes of peſtilence I ſuppoſe to be; firſt, ſome eſſential alteration in the primary qualities of air and water, owing to ſeaſons or the action of electricity, the main operative agent in the earth and atmoſphere; which alteration is demonſtrated by various epidemics, and ſpecially by catarrh. Secondly, the ſubordinate cauſes of plague are noxious exhalations of every kind, which diminiſh the proportion of vital air imbibed into the lungs. Both cauſes appear to produce diſeaſe, either by exceſſive excitement, inducing *indirect* debility; or by reducing excitement, and inducing *direct* debility. The aërial, or elemental cauſe, ſeems to produce exceſſive excitement; for its firſt effect appears in catarrh, a diſeaſe of ſtenic or in-

flammatory diathefis. Thus the prefent epidemic conftitution was introduced by influenza of univerfal prevalence, and of fevere fymptoms.

Meafles, another difeafe that rarely fails to characterize the early ftages of a peftilential conftitution, is alfo of an inflammatory diathefis. The fame is true of the common diftinct fmall-pox; another difeafe which, before the art of inoculation, feldom failed to rage in cities during fuch a conftitution.

Anginas are of different types; fome of the milder kinds are ranged by Brown among ftenic difeafes; but the angina maligna he confiders as aftenic. Difeafes of this clafs, however, form a part of the effects of the peftilential conftitution.

Next to this fpecies of difeafes, may be arranged the petechial fevers, which under the names of *purple* or *fpotted*, have often overfpread Europe, and rarely fail to precede the plague. Thefe are the product of the laft ftages of a peftilential conftitution, next to the true plague, which marks the crifis. Thefe forms of malignant fever have never occurred in America as epidemics; but purple and livid fpots, vibices, and all the varieties of eruptions which belong to that clafs of difeafes, occur occafionally during peftilence.

It is a remarkable fact, and one that feems to have efcaped obfervation, that a peftilential conftitution

ſtitution of air, in all ages and countries, produces epidemic diſorders of the *eruptive* kind. I queſtion, whether, in a ſingle inſtance, ſince the days of Moſes, the real plague ever became epidemic, without one, two, or all of that kind of diſeaſes for its precurſors. We cannot look into an author who has deſcribed the diſeaſes which prevail in ſuch a conſtitution, from Hippocrates down to our time, but we ſee *ignes ſacri*, *variola*, *morbilli*, or other eruptive diſorders, conſtituting a part of the deſcription. Theſe diſeaſes ſeem evidently to be claſſed by the laws of nature, and always to appear in cloſe connection.

Hence the propriety of Sydenham's obſervation, p. 120. that "the *eryſipelas*, *ignis ſacer*, is a good deal like the plague, and ſometimes accompanied with pains in the glands; that it begins much in the ſame manner as the plague; but the plague is much more violent than an eryſipelas."

Hence alſo we obſerve, that Hippocrates, in deſcribing a peſtilential conſtitution, mentions that before ſpring appeared "*eruſipilata polla*," many caſes of the eryſipelas, of a bad type, and mortal.

De Morb. Vulgar. Sec. 2.

This is a curious phænomenon, and worthy of inveſtigation, that a particular conſtitution of the atmoſphere ſhould, in its different ſtages, or in different

different ſeaſons of the year, tend to generate all thoſe diſeaſes which throw out upon the ſurface of the body petechiæ, vibices, a general efflorеſcence and tumours, with various other appearances. It belongs to medical men to explain the general proximate cauſe, which, while its effects are various, ſtill gives to diſeaſes ſome common ſimilitude.

In America the peſtilential conſtitution exhibits the ſame phenomena as meaſles and anginas, but without the purple or ſpotted fever, as the precurſor of our peſtilence. The immediate precurſors of the bilious plague in America, are catarrhous affections, diſorders of the throat, and eſpecially bilious fevers of a bad type, ending often in black vomit. Detached caſes of this latter diſeaſe rarely or never fail to introduce or precede the infectious epidemic.

But no diſeaſe whatever ſeems more cloſely connected with peſtilence than catarrh. An epidemic influenza is almoſt invariably the ſignal of the approach of a peſtilential conſtitution; and during the whole exiſtence of the conſtitution catarrhous affections are frequent in particular ſeaſons, eſpecially juſt before or after the prevalence of a peſtilential fever. This circumſtance affords no inconſiderable evidence, that what we call an epidemic conſtitution acts upon the human body as a violent ſtimulus. The firſt diſeaſes excited by it are uſually of the inflam-

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matory diathefis, as catarrh and meafles. Hence, perhaps, we derive a clue to explain the myftery of the peftilential difeafes which fucceed.

The continued effect of exceffive ftimulus muft be debility. The epidemic conftitution, when it firft commences, is mild, and produces ftenic difeafes, not very mortal, as catarrh and meafles; for a very obvious reafon, the force of the ftimulus is not at firft fufficient to haften on the indirect debility of the fyftem, or to produce the aftenic diathefis in a fatal degree. But as this ftate of air advances in ftrength, the ftimulus is greater; and when aided by the heat of fummer and noxious air, produces a degree of excitement that fpeedily induces univerfal debility. Hence the peftilential fevers of fummer and autumn feem to be the effect of exceffive ftimulus, acting upon the fyftem with fuch violence as to produce fpeedy debility; in confequence of which, all the functions of the fyftem are weakened and deranged, the ftomach does not digeft food—the periftaltic motion is imperfect and feeble—the liver and gall-bladder do not perform their fecretions—the energy of the brain is diminifhed—the extreme veffels are relaxed.—The confequence is, that part of aliment which ought to be feparated and carried off by the inteftines as the hepatic fluid, are retained, and forced out of their proper ducts into other parts of the fyftem, where they excite external eruptions, efflorefcence, or yellownefs in every part of the body, becoming

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rank poiſon, and ſpeedily inducing fever, morbid affections, and diſſolution.

This proceſs is infinitely modified by ſubordinate cauſes; as ſeaſons, which are extremely various; local exhalations and ſtagnant air, which are deleterious according to their force; the various modes of living, which ſtrengthen or weaken the human body; and accidental circumſtances, as fatigue, grief, fear, expoſure to exceſſive heat, or ſudden cold; and innumerable ſimilar cauſes.

This idea of the proximate cauſe of the bilious plague of our climate was imbibed from obſervation and converſation with phyſicians before I had read Brown's Elements of Medicine. I am happy enough to find, on reading that work, a confirmation of the opinion. That author obſerves, paragraph 137, "Sometimes the ſecretory veſſels ſeemed crammed with a calluvies of fluids, capable of producing indirect debility, as in that overflowing of bile which diſtinguiſhes the yellow fever of the torrid zone."

This "calluvies of fluids;" lodged in the ſecretory veſſels, ſeems to act like poiſon in diſorganizing the ſyſtem. And the reaſon why the plague is ſo often incurable, ſeems to be the rapidity and the imperceptibility of the action of that poiſon, which appears totally to undermine the vital powers, before it exhibits much pain or fever. This is not its common mode of operation; but it is not unfrequent. Caſes of this

this kind are soon characterized by a total prostration of strength, a cadaverous look, and a dull, glassy, languid eye, so often described by medical writers. In such cases debilitating remedies precipitate death, and stimulants are ineffectual to revive the languid functions.

In most cases, however, the approaches of the disease are accompanied with pains, uneasiness, and febrile symptoms, while the system yet retains its stenic diathesis; in some such cases, debilitating remedies are useful, but the rapidity of the progress of the poison soon changes the diathesis to astenic.

Boyle remarks, vol. i. p. 678, "that a day or two before the plague has manifested itself in some persons, their vision has been affected, objects appearing diversified with beautiful colours. A vomit administered to such usually gave relief." Every observation of such eminent men deserves consideration; but I do not remember to have found the same in any other author. If just, is it not an evidence that the state of air, inducing the disease, operates *first as a stimulus?*

Procopius has recorded of the plague of 543, a phenomenon somewhat similar to that noticed by Boyle. He says, persons imagined they saw phantoms or ghosts, which made them suppose they were smitten by some person. Such as had this imagination, soon perished with the plague.

In 746 alſo, perſons were troubled with phantaſtical images which filled them with terror.

See alſo the plague in Carthage, before Chriſt, 404.

General appearances favour the idea, that what is uſually called an epidemic ſtate of air, produces, in the human ſyſtem, unuſual excitement by exceſſive ſtimulus. But then how ſhall we account for the angina maligna, a diſeaſe of extreme aſtenic diatheſis, which often forms one of the ſeries of epidemics belonging to the ſame conſtitution?—Is this alſo the effect of exceſſive excitement, inducing great debility?—Is not its prevalence principally among children of ſound health a proof that it is the conſequence of indirect debility?

However theſe queſtions may be decided, certain it is, that under the ſame conſtitution, and during the ſame peſtilence, the fatal diſeaſes aſſume very different ſymptoms, and exhibit, in different bodies, a different diatheſis.—In all epidemics of this ſort, a principal object of the phyſician is to aſcertain the general diatheſis produced by the conſtitution of air, and the various effects of it in different bodies.—"*Hic labor, hoc opus eſt* *."

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* Is not the doctrine of indirect and direct debility, as the ſource of all diſeaſes, fully implied in the firſt paragraph of Ariſtotle's firſt Problem?—It may be thus rendered:—"Why have great exceſſes a tendency to produce diſeaſe, but

The ſecondary or auxiliary cauſes of plague, coming under the denomination of *impure air*, are ſuppoſed to act upon the ſyſtem by directly debilitating powers. "It cannot be doubted, ſays Brown, p. 145, that the application of air to the whole ſurface of the body is a neceſſary ſtimulus. The air is ſeldom applied in a pure ſtate; it is commonly blended with *foreign matters that diminiſh its ſtimulating powers*; and though its ſalutary ſtimulus depends upon its purity, it is uncertain whether ever its purity goes ſo far as to ſtimulate in exceſs, and thereby produce ſtenic diatheſis."—I know not what this author would call "purity of air," but I am very certain that an epidemic influenza proceeds from ſome qualities in the atmoſphere; and this author agrees the diſeaſe to be a ſtenic diatheſis.—If the diſeaſe is the effect of "foreign matter," infuſed into the air, then this foreign matter is a ſtimulating quality.

I ſuſpect, however, that the atmoſphere ſhould be conſidered as compoſed of two principal ſubſtances, *air* and fire, or *electricity*. Morbid matter floats in the *air*, but the principal ſtimu-

but becauſe they occaſion too much or too little excitement, in which all diſeaſes conſiſt?" If this is not the preciſe idea of the author, his doctrine leads to the ſame reſults as thoſe which form the ingenious Brunonian ſyſtem. Many things appear to us new, which are 2,000 years old; and ſolely becauſe we neglect ancient authors.

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lating power probably consists in the *electricity* of the atmosphere.

The influence of morbid exhalations from putrefying substances, is, probably, to diminish the stimulant power of the atmosphere, inducing direct debility.—The lungs receive, at every breath, a certain quantity of air; that is, about the same cubic quantity. A certain portion of this is vital air, oxygen, which serves as food for the lungs and blood, and which is separated from the rest and absorbed. Whenever therefore common air is impregnated with an undue proportion of hydrogene, or with any species of acid which is hostile to the lungs, these viscera want their proportion of food or stimulus; the consequence is, their action is weakened, and the heart and arteries want their due force; the effect of which is a more feeble circulation of blood. Perhaps also, the septic acid, conveyed to the blood with common air, at every inspiration, gradually destroys its texture.

Sorbait mentions, that a lighted candle, being placed near persons dying with the plague, a livid vapour has been seen issuing from their mouths.—Extremely vitiated must be the air from the lungs before it can be rendered inflammable.

But whatever may be the process, we know the effects of respiration in air vitiated by morbid exhalations to be fevers of various kinds, as intermitting, remitting, dysenteric, and putrid, or pestilential.

That

That ſtate of the atmoſphere which I call *peſtilential*, has a ſingular effect in increaſing the irritability of the nervous ſyſtem, by which means ſlighter cauſes than uſual occaſion dangerous inflammation.

Having then arrived at the probable cauſes of the peſtilential fevers which afflict the earth, we are prepared to conſider the means of prevention.

The firſt article under this head is, the removal of all local cauſes of diſeaſe; ſuch as every ſpecies of putreſcible ſubſtance, which, in the proceſs of putrefaction, emit a ſpecies of air highly unfriendly to health. It will be obſerved, that I ſpeak of *putreſcible* ſubſtances; for fleſh or vegetables, which have undergone the proceſs of putrefaction, or of digeſtion in a healthy ſtomach, diſcharge little or none of the pernicious acid.

Hence we obſerve, that people in cities rely too much on cleanſing their ſtreets to preſerve public health. Experience proves that the utmoſt care in cleanſing ſtreets will not always prevent peſtilence. The reaſon is obvious; moſt of the filth of ſtreets conſiſts of excrementitious matter from horſes or oxen, which has undergone the proceſs mentioned, and contains no ſeptic acid, or very little. Hence the accumulation of dung in the farmer's yard is not known to generate diſeaſes.

Various other substances, thrown into the streets of cities, are more pernicious; as green vegetables, the garbage of fish, lees of fermenting liquors, and many others, which, in hot weather, soon putrefy and discharge noxious air. Such substances, however, ought never to be thrown into the streets in hot weather; they should be thrown into the ocean, into rivers of running water, or what is better still, *buried*; and that before putrefaction begins. If putrefaction is begun, they should be removed in covered vessels.

The vaults of Cloacina, although they contain mostly substances which have passed through digestion, and in their unmixed state are not *very* pernicious, yet they are always mixed with other substances, which, in hot weather, bring on fermentation. These should be either cleansed annually in spring, or the matter in them neutralized by quick-lime.

All filthy substances should be removed from streets, both for the sake of decency and health. If the pavements of streets could be covered with pure earth, it would greatly lessen the heat; but this is not practicable. The only effectual remedy is, fresh running water—the only article that unites cleanliness with coolness. Nothing in a city can be an adequate substitute; for while it removes the cause of noxious vapours, and by cooling the sultry air of a city prevents debility,

it extricates a confiderable quantity of new and wholefome air from its own fubftance.

Streets fhould be fo conftructed as to give the water a confiderable velocity. The practice of levelling the furface of a city is moft pernicious. If poffible, every ftreet in a city fhould have a defcent of fifteen or twenty degrees. Inftead of levelling the earth, the police of a city fhould counteract even a natural level, by throwing the whole into artificial elevations, which give a brifker currency both to water and air.

Cellars fhould be fo conftructed as to retain no water, and often cleanfed by fcraping. If the furface of a cellar can be conveniently changed, by removing a few inches of the old earth, and introducing that which is frefh, it would be a very falutary labour. Nothing imbibes and neutralizes infectious matter more readily than frefh earth.

The liberal ufe of water, in and about a houfe, cannot be too ferioufly recommended. Water abforbs all noxious matter that comes in contact with it in fubftance.—Applied to floors, wooden, ftone or brick, walls; to clothes, to furniture, to back-yards, and ftreets; it is every where falutary in the fummer months. Dr. Prieftley obferves, that water purifies vitiated air by abforbing the feptic part. Hence its great utility as a prefervative againft peftilential difeafes.

All dead animals in a city, or its vicinity, ſhould be buried or burnt; as cats, dogs and horſes.— The indecency alone of ſuffering their carcaſſes to putrefy before the eyes of mankind, ought to make it a ſtrict article of police to remove them; but they ſhould be buried; not one ſhould be permitted to offend the eyes or noſtrils of a citizen *. They are offenſive to decency, to moral ſentiments, and to health. The ancient method of burning dead bodies was well calculated to deſtroy the poiſon; but in Atlantic America burial is cheaper and equally effectual.

Common ſewers are often common nuiſances. In cities, all filthy ſubſtances ſhould be conveyed off from the viſible ſurface of the earth, unleſs ſewers could be ſo conſtructed as to depoſit, with certainty, all their contents in running water. Serious evils ariſe from putrid ſubſtances lodged in ſewers that are too level, and which ſerve as reſervoirs inſtead of canals, accumulating putreſcible matters, in places where their exhalations, by the influence of moiſture, are doubled, inſtead of being removed.

In cities, where all filth is naturally caſt by rains into the docks, it would be well that all wharfs ſhould be ſo conſtructed, as to preſent a

* From two years obſervations, made as I paſſed daily from New York to my reſidence in the country, I judge from twenty to thirty worn-out cart-horſes die and putrefy in the ſuburbs of that city every year.

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ſmooth uniform front to the ſtream, and be extended into deep water. Mud, waſhed by the ſalt tides, and not mixed with putreſcible matters, produces no inconvenience to health; but ſuch matters thrown into docks bare at low water, and expoſed to a hot ſun, diſſolve moſt rapidly, and generate morbid vapours. Many improvements are yet to be made in our ſea ports, which will leſſen the accumulation of pernicious air.

A great and moſt deſirable article in a ſyſtem for the preſervation of health, is, the purifying of rooms from air which has been reſpired for a length of time. By experiment it is found, that the air of rooms that have been ſlept in, is very inſalubrious; and probably more ſo than the air of privies, which is found to contain leſs noxious air than was formerly ſuppoſed. See Encyclopedia, Art. Atmoſphere. Indeed, it is queſtionable whether there is any neceſſary connection between offenſive ſmells and inſalubrity. Nature has kindly provided that dead fœces ſhould not be very pernicious to health; but the effluvia of living and fermenting bodies are to be avoided as rank poiſon. In this reſpect, cleanlineſs is made eſſential to health.

It is impoſſible in a work of this kind to enter upon the details of cleanſing a great commercial city. The magiſtrates, aided by medical men, in every city, will attend to the minute regulations for preſerving a pure air.

But

But there are other causes of autumnal diseases, which must not be overlooked.

It is remarked by writers, that the diseases from marshes and stagnant waters are most violent near their sources; and gradually abate in their violence, and become less common, as they recede from their sources. See Buil on the Marsh Fevers at Sheffield. Medical Repos. vol. i. 457. Hence in a country generally mountainous or hilly, dry, and salubrious, but containing here and there a pond of dead water or marsh, the bilious fevers generated by the effluvia will be local, rarely extending one mile and a quarter from their source.

But there are some extensive marshes which may produce effects to a much greater distance. Such are the low grounds in Hungary, a sickly region; the Pontine marshes near Naples, which may affect the health of people in Rome; the flat lands and rice plantations in Bengal on the Ganges; the coast of Terra Firma in South America, and the marshes from East Florida to the Delaware in North America. The fenns in Cambridge, Ely and Lincolnshire, in England, may be classed with those abovementioned, but are of smaller extent.

It is an opinion in Constantinople, that the frequency of the plague in that city, is to be attributed to the northerly winds, which come from the marshes in Tartary and Russia, bordering

ing on the Euxine, ſweeping that ſea, and conveying moiſture and noxious exhalations.

The poſition of that city is otherwiſe a healthy one—the climate is temperate—the ſcite of the city high, dry, and riſing into hills and mountains on the weſt. No cauſe of unuſual diſeaſes can be found in the neighbourhood. The cauſes within the city are powerful. Many of the ſtreets are narrow, filthy, crouded, and almoſt obſtructed by pent houſes. But in this reſpect Conſtantinople is not worſe than one half the cities in Europe. Shall we then admit that winds will convey morbid exhalations ſeveral hundred miles, without diſſipating them, ſo as to render them innoxious? Let us attend to other facts.

No city in Europe, except Conſtantinople, has been more frequently deſolated by plagues than Rome, from the time of Romulus to the cloſe of the laſt century. Shall we aſcribe this to the vaſt marſhes which border the ſhore from the mouths of the Tiber to Naples?—Certain it is, that Rome has ever been conſidered as a very unhealthy city; and the terrible plagues which ravaged it when in the utmoſt proſperity, as well as in modern times, juſtify this opinion. So ſenſible have the inhabitants been of the prevalence of this opinion abroad, and the ill effects of it in preventing ſtrangers from reſorting to the city, that Lanciſius, an eminent phyſician of the preſent

ſent century, wrote a conſiderable treatiſe, evidently with a view to remove this opinion.

This author obſerves, that ſouth winds at Rome, if violent, humid, with clouds and heat, produce inconvenience, and if they paſs over marſh, they may bring "*particulas lethiſeras,*" very pernicious vapours, which produce peſtilential diſeaſes.

The Romans very early took meaſures to correct the evils to which the city was expoſed.—The enormous *Cloacæ*, or ſewers, were raiſed at a vaſt expence, to carry off all ſtagnant water, and dry the ſoil, and while kept clean, were very uſeful. Hence Cloacina was deified as the Goddeſs of Health. Theſe ſewers were under the care of certain officers, called "*Curatores Cloacarum Urbis.*" In one inſtance theſe drains had been a long time neglected, and were cleanſed at the expence of a thouſand talents. Severe laws were enacted, prohibiting individuals, under penalty of a fine, to ſuffer water to ſtagnate.

Lanciſius aſcribes the ſevere diſeaſes which afflicted Rome, in the decline of the Empire, to the deſtruction of the aqueducts and neglect of the ſewers. In 1695 when the ditch of Adrian's tower, and the great ſewer of the city Leontini were filled with filth, immediately on the blowing of the ſouth wind, began peſtilential diſeaſes. By order of the Pope, at this author's ſuggeſtion, the ſtreets, vaults, ditches, and all ſimilar places, were

were thoroughly cleanſed, and ten years after no epidemic malignant diſeaſe had appeared. He however obſerves, that when a ſouth wind blows *for a long time*, acute fevers, tertians, pains in the head and vertigo, become epidemic. This muſt be occaſioned by the debilitating effects of that wind, or by *miaſmata* conveyed from a diſtance, poſſibly from the Pontine marſhes.

See Lanciſius, paſſim.

Egypt is a flat country, containing not much marſh, but annually overflowed, and ſubject to moſt of the inconveniences of marſhy countries, from the drying of its moiſt ſurface in very hot weather. Here again we have a nurſery of peſtilence.

The banks of the Euphrates and Tigris are nearly in the ſame predicament, and Baſſora is in Perſia, what Cairo is in Egypt.

Moſt of the coaſt of South America, from Carthagena to the Oronoke, is bordered with marſh, and is every where ſickly.

But what ſhall we ſay to the marſh on our own ſhore? The low ſwampy lands that border all the rivers in the flat country of Maryland, Virginia, and the Carolinas, and the immenſe tract of bog in Virginia called the *Diſmal?* The effects of them on the neighbouring inhabitants are well known—annual and almoſt univerſal intermittents, and often remittents.

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Is it not poſſible and probable, that the noxious exhalations from theſe vaſt hot-beds of putrefaction, are borne on the ſouth-weſterly winds, which prevail almoſt conſtantly in June, July, and Auguſt, and which run parallel with the general tending of the coaſt, from Florida to New York? Do they not impregnate the whole atmoſphere for a conſiderable breadth, and ſweep the country from the eaſtern ſhore of the Cheſapeek to Philadelphia, New Jerſey, and in a ſlighter degree to New York? I do not give a poſitive opinion on this ſubject; but the annual prevalence of ſlight intermittents on York Iſland, and in the city, though far removed from any marſh, and continually ventilated by ſea breezes, as well as waſhed by rapid tides, affords ſome ground to believe this ſuggeſtion.

It is confirmatory of this idea, that ſoon after leaving York Iſland towards the eaſt, all intermittents diſappear; unleſs in a very few places, when they proceed from obvious local cauſes— now it muſt be obſerved, that the coaſt of the United States, runs generally from South-weſt to North-eaſt; but at New York it takes a different courſe, and runs about eaſt by north for two hundred miles. This courſe ſoon carries the people, on the ſhore, beyond the reach of the ſuppoſed ſtream of morbid vapour from the ſouthern marſhes, whoſe courſe is with the ſouth-weſterly winds.

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I am not attached to this idea; but it is in conformity with the opinion of the insalubrity of the Euxine winds at Constantinople, and with the effects of the southerly Calabrian winds blowing over the Pontine marshes towards Rome. Lancisius relates a remarkable fact. Thirty gentlemen and ladies went on a party of pleasure towards the mouth of the Tiber. The wind shifted suddenly and blew from the marshes, "*paludes ostienses*," and twenty-nine of them were immediately seized with a tertian. If such was the effect of the vapours from those marshes, we may suppose the vast Pontine marsh would poison the air to a much greater distance.

That the extensive morasses along our southern shore are pregnant with mischief to that country is certain; that the people of Philadelphia and New-York are affected by them, may be possible. It would therefore deserve consideration, whether the evil will admit of a remedy. There are two modes of rendering marshy lands and stagnating water salubrious—one, by draining the lands and cultivating them; the other, by turning into them streams of running water. It is probable, that most of the marsh at the southward, being within reach of tides and below high water, is incapable of being drained. It is the Pontine region of North America. How far the second plan can be applied with success, I have not the local knowledge of the land and rivers to determine.

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The claſſic reader will recollect the inſtance related in the hiſtory of Empedocles, the Sicilian philoſopher and poet, who put an end to peſtilential diſeaſes among the Salacentii, by turning two ſtreams of good water into the marſhes from which they originated.

If there is a poſſibility of drying any of the lands now covered with poiſon, or of putting the dead water into motion, the United States have a vaſt intereſt in effecting that object; and expences are not to be put in competition with the health and lives of our citizens.

The ſame remark is applicable to all the marſhes in other parts of the country, as about ſome of the lakes; and to all ſmaller ſources of diſeaſe, ſwamps and ponds. In every poſſible ſituation, when ſtagnant water contains vegetable ſubſtances in abundance, diſeaſes muſt prevail. Running water, on the other hand, is ſalubrious. It not only does not exhale morbid air, but it generates freſh and pure air; at the ſame time, it creates a gentle breeze by its current, which helps to diſſipate any noxious particles in its neighbourhood which may ariſe from other ſources.

People in the country cannot be too careful in ſelecting a ſpot for their habitation. The queſtion, of continued health or diſeaſe, of long life or premature death, hangs very often upon the choice of a ſalubrious ſituation for a houſe. A farmer ſhould never plant his dwelling by the ſide

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of a marſh. Whatever may be the ſituation of his land, he is inexcuſable if he builds his manſion within a mile of the ſources of diſeaſe and death. Better for him to go a mile and a half to his daily labour, enjoying robuſt health, than to live within the circulation of poiſonous vapours, afflicted by diſeaſes for three months in a year. And when a farmer has the misfortune to be obliged to labour occaſionally in the vicinity of ſtagnant water, he ſhould be careful not to enter upon the ground early in the morning, before the noxious vapours have been raiſed and attenuated by the heat of the ſun; nor ſhould he continue there late in the evening.

People in the country ſhould ſelect hilly or elevated ſituations for their houſes, where the ſurface of the earth is dry, and there is a free circulation of pure air. There is another reaſon—the water on high ground is always better than in low, ſwampy places. Water in flat land ſtagnates beneath the ſurface, as well as above; but on hills, it is in conſtant motion. Hence if men expect good water, they muſt ſeek for it on mountains, hills, and riſing grounds. The Arabians adviſe that houſes ſhould be ſet on high, airy places, near freſh water.

When a choice of difficulties occurs, and men are compelled to live near marſhes, they ſhould endeavour to place their dwelling on the windward ſide of the marſh, which in America is the

ſouth and weſt; the ſummer winds being from theſe points. This will often make a prodigious difference in the ſtate of health.

The fables of antiquity are moſtly obſcure and not well underſtood by moderns; but ſome of them are eaſily explained, and contain moſt excellent leſſons. The ſtory of Python, the huge ſerpent which alarmed and infeſted the world until he was ſlain by Apollo, is of this kind. Python was generated by the action of heat on the mud and ſlime which covered the earth, after the receſs of the water of Ducalion's flood. That is, Python was diſeaſe, proceeding from noxious exhalations in hot ſeaſons, which was deſtroyed by Apollo, the Sun, which dried and purified the earth.—See Ovid Metam. lib. i.—This fable had its origin in Egypt, where Python was killed by Iſis and Oxus.

Of what conſequence is it that we read books, if we neither underſtand nor practiſe the leſſons they contain?

But after attending to every circumſtance that can aſſiſt in guarding health from the annoyances that are local and viſible, we have a further taſk to perform, to leſſen the effect of that elemental principle of diſeaſe, which has been proved to exiſt in every clime at certain unequal periods. If, it will be ſaid, ſuch a cauſe of epidemic diſeaſes does in fact exiſt and operate on every ſpecies of life, vegetable and animal, this cauſe is

above

above human controul; all our efforts to avoid its effects are uselefs; and we are doomed, by the decrees of Heaven, to be the victims of peftilence without hopes or remedy.

To this I anfwer, that if all hiftory is not a forgery, the ftate of the elements has, in a few inftances, been fo ill-adapted to fupport health and life, or fo pofitively pernicious, that men have perifhed by millions in the moft healthy regions, expofed to no local caufes of difeafe whatever, except fuch as exift in the moft healthy periods.

This I muft believe; but the fact affords no grounds of complaint againft Providence, for the fame fate has attended all other fpecies of animals. The horfe, the ox, the fheep, the dog, the cat, the fowls, and the fifh, are fubject to the fame univerfal law of the phyfical world; and on what principle will man arraign this difpofition of all-created life, or claim exemption from the laws to which all other fpecies of animals are fubjected?

But we are not altogether without hope, even in the defperate circumftances mentioned. If we attend to the caufes of plagues, we fhall find they all tend to deftroy life by *one general effect*, which is *debility*. Either directly or indirectly, all the exciting caufes clofe their operation on the fyftem, by inducing *debility*, leaving the nerves,

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muſcles, and inteſtines, in a relaxed, languid ſtate.

If this principle is juſt, and it is agreeable to the medical idea that debility is the cauſe of all fevers, we have a clue that will lead us to the means of eſcaping the evils of peſtilence.

In the morbid ſtate of air, producing the uncontroulable peſtilences which have aſſailed man in the healthieſt ſituations on the globe, we obſerve, that the moſt terrible effects have been produced in ſeaſons when the air has been warm, humid, unelaſtic, with light ſoutherly breezes; as in the reign of M. Aurelius, of Gallienus, and Edward III. This ſtate of the air ſerved very much to aid the peſtilential principle in debilitating the human body. All local cauſes probably tend to the ſame effect.

The great deſideratum then is, how to counteract the debilitating operation of thoſe cauſes, and *preſerve the tone of the ſyſtem.* I am perſuaded that all the means of prevention are compriſed in that idea. No man is taken ill with this furious diſeaſe, until his nervous ſyſtem and his inteſtines ceaſe to perform their uſual functions, and ſecretions are ſuſpended or diminiſhed. Hence perſons, as long as their evacuations are regular, may walk with ſafety in the moſt infected places, until their eyes and their colour exhibit the poiſon that is imbibed; yet they will not ſuffer by the diſeaſe,

eaſe, while the veſſels have ſtrength to diſcharge the morbid matter by regular evacuations. This is a known and a common faćt.

Hence ſome perſons, and even phyſicians, have reſorted during the plague to ſmall doſes of calomel, or other purgative, to keep open bowels. A moſt pernicious praćtice to thoſe in health, for it induces the very evil meant to be avoided, *debility*; and ultimately, the inteſtines becoming unable to perform their funćtions, diſeaſe and death enſue. I am well informed of a number of caſes of this kind in New-York, the laſt ſummer, which ended in death.

The true means to preſerve the natural tone of the body, are the *moſt natural means.*

Firſt. Food is the natural ſtimulus of the ſyſtem. During peſtilence, therefore, this article demands the firſt notice. It is agreed by all writers, and obſervation juſtifies the opinion, that temperance is eſſential to health during a ſickly ſeaſon. Some perſons, miſtaking temperance for abſtinence, have run into an extreme of abſtinence, which has been fatal to them. The true point to be obſerved is, to take as much food and drink as will ſuſtain the body in its uſual degree of ſtrength, without overcharging it with ſtimulus. Too much food produces unuſual excitement, which is followed by indirećt debility, a ſtate of body which invites an attack of peſtilence. Too little nouriſhment, on the other

 hand,

hand, induces direct debility, a ſtate equally favourable to diſeaſe. I have good grounds for believing ſome very valuable citizens of New-York, of my acquaintance, fell ſacrifices to their exceſs of caution in the uſe of food during the laſt epidemic.

It is not improbable that different conſtitutions of air, as they produce various ſymptoms in the ſame diſeaſes, may require or admit of very different degrees of ſtimulus, applied to the human body. The epidemic in New-York in 1795, like that in Philadelphia in 1793, was characterized with inflammatory diatheſis more frequently than 1798. Hence veneſection, which had acquired great celebrity in 1793, loſt part of its credit in 1798, and was uſed with more diſcrimination and caution.

I ſuſpect the ſame circumſtance has changed or modified the opinion, of the great utility of abſtaining from generous diet and liquors. This opinion was general and well received in 1795; nor have any caſes come to my knowledge, in which the practice was ſuppoſed to be injurious. But in 1798, many inſtances occurred when perſons of the moſt ſlender habits, of ſtrict abſtinence from ſtimulating diet, and who weakened the ſyſtem by purges, were ſeized with uncommon violence by the peſtilence and periſhed. On the contrary, I am acquainted with ſeveral phyſicians, who took their uſual quantity of food, with ſome

wine, and more than their customary quantity of porter, who attended the sick through the season, visiting the most infected places, without suffering the least inconvenience to their health.

If the point is admitted, that debility is the great proximate cause of this disease, which I think cannot be contested, the consequence is plain, that whatever tends to reduce the vigour of the system below its usual standard, must be prejudicial during its prevalence. Hence the propriety of rather increasing than lessening the usual quantity of food, or natural stimulus; carefully avoiding, at the same time, all excess in eating and drinking, which is equally dangerous.

Another thing to be observed in summer, and especially in time of pestilence, is the guarding the body, but by all means, the head, from the direct rays of the sun. Nothing is more dangerous than the burning heat of a clear sun in sultry weather. It often produces sudden death, by means of an apoplexy, instances of which are related under the year 1752 to have happened in Charlestown; and the same is said to have taken place there the summer past. In other cases, the effect is, what is called a stroke of the sun, "*coup du soliel,*" which is not always fatal, but very dangerous.

But the most general ill-effect of exposure to a hot sun is, great debility in consequence of the violent and unnatural excitement; and this effect

is moſt to be feared in the nervous ſyſtem when the heat has fallen directly on the head. Convaleſcents from bilious fevers have occaſion to be particularly cautious not to expoſe themſelves to a hot ſun; a relapſe is the moſt certain conſequence.

The umbrella is an excellent invention; it would be ſtill more excellent if it could be improved, ſo as to render the ſhade more general, and completely intercept the rays of the ſun, without being rendered too heavy.

In walking the ſtreets of a city in a clear hot day, the paſſenger will naturally ſeek the ſhady ſide. Of ſo much importance is it thought, in ſome hot countries, to ſhield the body from the rays of the ſun, that very diſcerning men contend that narrow ſtreets and high houſes, in cities, contribute to the health of the citizens, by mitigating the heat. They ſuppoſe the obſtruction of air a leſs evil than a hot ſun. Of this opinion was Lanciſius.

But this is to embrace one evil in ſhunning another. It is to be regretted, that the beſt mode of ſhielding men from a hot ſun is not adopted in cities. Wide ſtreets, bordered with rows of trees, would be infinitely preferable to all the artificial ſhades that can be invented. Trees are the coolers given to us by nature. They make a pleaſant ſhade; they imbibe the ſeptic fluids, which impregnate the atmoſphere of cities, and poiſon

poiſon their inhabitants; they exhale pure air; they fan the earth, by creating or augmenting currents of air with the vibratory movements of their leaves; they invite the feathered tribe to light on their branches, and with the muſic of their notes to relieve the ear from the grating of rough, unnatural ſounds, which ſtun the citizen.

It has been objected to trees, that they increaſe the danger of fire, by obſtructing the free uſe of engines. This objection is imaginary. Few caſes would occur, where trees, properly placed, could interfere with the operations of extinguiſhing fire; and in ſuch caſes they might be levelled in a moment.

It has alſo been objected, that trees obſtruct the free circulation of air. This is not true. In calm ſummer weather they very much increaſe a light breeze, by partly obſtructing the upper current with their branches, and throwing more air below; thus augmenting the under current on the ſurface of the earth, where it is wanted. The leaves and branches alſo, by their gentle motion, agitate the air, preventing the ill-effects of ſtagnation; and give velocity to the air that finds its way through their interſtices.

"The ſtreets and public ſquares of a city," ſays St. Pierre, "ſhould be planted with great trees of various ſorts. A city built of marble would,

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to me, have a melancholy appearance, unless I could see in it trees and verdure."

Studies of Nature, 13.

Trees and all green vegetables diminish greatly the heat near the earth; and little do men in general think how prejudicial to health is the operation of the extreme heat of cities.

It is not an uncommon thing in the country, when no miasmata exist, for labouring men to over-heat themselves in the field, and die in six days with a bilious fever, their bodies as yellow as saffron. This is a yellow fever of a mild kind, generated in the system by the debility occasioned by excessive heat and fatigue, without any external cause. Thus the extreme heat of August and September 1798 will alone account for the unusual violence and extent of the pestilential fever of that year.

In the warm season, and especially in the time of epidemic fevers, people should be doubly cautious not to expose their health by excessive fatigue. Labour should not be violent, and walking moderate. In extreme heat the natural excitement of the system is usually too great; a small addition of it thaws the body into a state of debility which invites disease. Not only health, but life is often suspended on the point of half an hour's exercise. Temperance in labour,

bodily

bodily and mental, is as essential to goodhealth, as in eating or drinking. The muscles and the nerves, those moving powers of the human body, if stimulated beyond a certain point, lose their excitability, beyond the possibility of a recovery.

The danger incurred by sedentary and studious men, during pestilence, from the debilitating effects of their occupations, is greatly increased. Want of due exercise is directly relaxing to the solids; while application of the mind is apt to over-excite the nerves and induce indirect debility. The extreme irritability of the nervous system is obvious in a pestilential state of air—I experienced it most sensibly in the summer of 1795, during the fever in New-York; and it is evidenced in the vertigo, so frequent at such times; in the seizure of many persons in the plague with apoplectic symptoms; and in the palsies and apoplexies which are greatly multiplied before or after the prevalence of a pestilence, and which in some places have become almost epidemic.

During the rage of epidemic pestilence also the animal appetite should be indulged with moderation—excessive indulgence, which might have been sustained at other times, has oftentimes hurried the young and sprightly to a premature grave. Nothing can be more dangerous; according to all medical writers on this subject.

Celsus directs that in pestilence, persons should seek fresh air, travel, sail; or if these are not con-

convenient, they ſhould avoid fatigue, indigeſtion, cold, heat, exceſſive indulgence of the animal deſires; eſpecially, ſays the Author, in a peſtilence which is occaſioned by ſoutherly winds.

Vol. i. 40. 41.

Theſe obſervations are not new; they are common and well known to medical men, and to all others of diſcernment. They are here inſerted, becauſe they may be in this work more generally read than in medical books, which are opened only by profeſſional men.

But all theſe rules, if ſtrictly obſerved, will not, in a more violent plague, be ſufficient to ſecure the body from attack. Such are the extremely debilitating qualities of the air, in ſome periods, that it will be neceſſary to counteract them by artificial powers poſitively tonic.

The application for this purpoſe which is moſt eaſy and effectual, is *water*; an article which nature has furniſhed in the greateſt abundance, becauſe it is far the moſt uſeful. On this ſubject, perhaps, the following ideas may not be common.

My attention to water, as a prevention of peſtilence, was firſt excited by a paſſage in Volney's Travels in Egypt and Syria, chap. xvii. where he informs in a note, that "At Cairo, it is obſerved, the water carriers, continually wet with the freſh water they carry in ſkins upon their backs, are

never

never ſubject to the plague."---The author is there ſpeaking of the pernicious effects of humidity on health; but the eſcape of the water-carriers he aſcribes to *lotion*, whoſe effects are different from thoſe of moiſture by vapour.

If this fact is accurately ſtated it is worth an empire. I am inclined to believe it, and to aſcribe the eſcape of theſe men to the conſtant application of water to their bodies, during the labours of the day. Yet, if true, why have not authors propagated the knowledge of ſo important a truth to every part of the world? Is this neglect alſo the fruit of the pernicious errors reſpecting the excluſive origin of the plague from infection? The calamities ſuſtained by mankind in conſequence of thoſe errors exceed all calculation.

How is it poſſible, that, if a remedy for the calamity of peſtilence is ſo obvious and near at hand, the Egyptians ſhould not have applied it univerſally? Can this be aſcribed to the doctrine of predeſtination, which makes them careleſs of the means of prevention?

It is very certain that the laws of Moſes, reſpecting the prohibition of blood, fat, ſwine's fleſh, and certain other animals; as alſo the whole ſyſtem of ablutions, purifications, and uſe of perfumes, was intended to correct the evils of the climate; and many of his directions became totally uſeleſs when the Iſraelites left that country

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and its vicinity. Heaven never could intend some of the provisions of the Mosaic code for more temperate and healthy climates.

The ancient Egyptians had similar practices, and probably long before the days of Moses. Their laws and customs to ensure cleanliness were very strict, and they involved a most liberal use of water. Herodotus expressly declares, that "they scour their cups, wash their linen, and *circumcise for the sake of cleanliness.* The priests bathe twice by day and twice by night, and are obliged to wear linen." Swine's flesh was also considered to be unclean and prohibited as an article of food.

* See Book ii. Euterpe.

These regulations, doubtless, proceeded from the experience of their good effects. It is not improbable that the introduction of the Mahometan religion, may have been accompanied with the abolition or disuse of ancient practices, which were friendly to health. Certain it is, that the oriental nations make great use of baths, the original design of which was probably to guard against diseases, but which have been abused and converted to the purposes of luxury.

Let us then pursue the idea of applying water as a panoply against the attacks of pestilence. By what means does water guard the body from that disease?

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I have already quoted the obſervation of Dr. Prieſtley, to prove that water abſorbs the ſeptic acid. If this opinion is well founded, and I have no doubt of it, we have obtained a moſt eſſential *item* of knowledge. Freſh water frequently applied to the body receives and carries off all the matter of infection, thus removing *one* copious ſource of the diſeaſe.

Savary remarks, that peſtiferous matter paſſed through water will not communicate the diſtemper. This is a confirmation of Dr. Prieſtley's principle.

The ceſſation of the plague in Egypt, on the inundation of the Nile, is no ſmall evidence of the ſame principle. The water changes the ſtate of the air, both by abſorption, that is, imbibing and carrying off the peſtiferous ſources of vapour from the earth, and by extricating a quantity of freſh air. And this important fact directs to the mode by which all great cities are to prevent or leſſen the force of this diſeaſe. What the Nile does once a year for Egypt, freſh ſtreams of water ſhould do every day in the *hot ſeaſon* for large towns, they ſhould inundate the ſtreets. Nature has given, in Egypt, the moſt ancient and moſt common nurſery of the plague, the *model* of the beſt remedy for the ſevereſt calamity incident to man, a model which few cities have been wiſe enough to copy.

But

But it will not be ſufficient to truſt wholly to the effect of a diffuſion of water over a city. In the hot ſeaſon, it ſhould be applied to the body very frequently, in the way of lotion or bathing. By this I do not mean to recommend the practice of leaping into river or ſea-water, and continuing in it for half an hour—a practice which proves fatal to many lives every ſummer. Cold water is the moſt powerfully debilitating application that can be made to the body. No perſon can bear it, even in ſummer, but the healthy and robuſt; and to ſave ſuch from injury, it muſt not be applied when the body is over-heated, or continued too long. Many—many inſtances occur every year, in which a fatal yellow fever is ſpeedily induced by injudicious plunging. An inſtantaneous application of cold water to the body, by a ſingle plunge, or by a ſhower-bath, ſometimes acts as a ſtimulant, by a ſudden increaſe of excitability in the ſyſtem; but this ſhould be uſed as a remedy under the direction of a phyſician. Few perſons can ſuſtain the ſhock, unleſs in good health; and I am perſuaded it would be as well for mankind if the uſe of cold water by plunging were wholly proſcribed. Judiciouſly applied, it is ſometimes uſeful; but my own obſervations lead me to believe the utility is more than over-balanced by its fatal or miſchievous effects.

The moſt ſafe, eaſy, pleaſant, and beneficial mode of uſing water, is, to bathe or waſh the body

body in a private apartment at home. This may be done in ſeveral ways—either in a large veſſel, immerſing the whole body at once; or, what is leſs troubleſome, with a ſingle pail or bowl of water, in a bed-chamber. The waſhing may be done with the hand, or a ſponge, in a few minutes, as the perſon riſes in the morning, or retires at night.

The temperature of the water ſhould be near that of the blood; a little cooler, or a little warmer, and in ſuch a temperature, it is a pleaſant application, occaſioning no violence to the ſyſtem.

It may not be obvious to every common reader, that the application of warm water to the ſurface of the body, in a hot day, ſhould cool it. But ſuch is the fact; and nature points out this mode of reducing the heat of the body by the proceſs of perſpiration. In this proceſs the inſenſible vapour which eſcapes by the perſpiratory ducts, takes with it a portion of heat; and the more freely a perſon perſpires, the more temperate the heat of his body. Hence the human body is enabled to ſuſtain heat ſeveral degrees above that of the blood; and hence the fleſh of a child in full health, perſpiring freely, feels cooler than the air in a ſummer's day. This phenomenon may be illuſtrated by a thermometer, with the utmoſt eaſe. Immerſe the bulb in warm water, in a hot day. Let the water be of 75 degrees of heat, and the air of 80°. The thermometer, ſtanding at 75

 in

in the water, and taken out into a warmer medium, the air ought to rise to 80; but being wet, the evaporation will sink the mercury four or five degrees; that is, to about 70°, until the instrument is dry, when it will rise to 80°, the temperature of the air.

On this principle, warm water, as well as cool, will lessen the heat of the system; for no sooner does a person cease to apply the water, than evaporation commences, and cools the body by several degrees. This effect, however, is temporary, in consequence of the stimulus of the heat.

In very hot weather it is better, especially for persons in the vigour of health, to use water a little cooler than the blood; for the effect of warm water, applied in the manner proposed, is to stimulate; and this is not what the body requires. On the contrary, when highly excited by the heat of air, the body requires a reduction of heat, to prevent over-excitement, and its effect, indirect debility. In general, then, the body in summer is to be cooled by the use of water while in a healthy state; but if debility or disease has invaded it, it requires heat and excitement.

Persons of *a slender habit*, who require additional stimulus, should use water a little warmer than the blood. The effect of cool water applied to persons in full health, and of warm water to feeble

feeble habits, is the ſame, to *prevent debility*; *indirect* in the former caſe, and *direct* in the latter.

Bathing a long time in very warm water, to produce profuſe perſpiration, is a powerful laxative; and perhaps it would be better if it was never uſed, except as a remedy for diſeaſe under the direction of phyſicians.

The beneficial effects of the uſe of water in peſtilence, therefore, are theſe:—The poiſonous particles compoſing infection, and exhalations of all kinds, are waſhed from the body, and their ill effects prevented. The morbid matter exhaled from the body by the perſpiratory veſſels, is alſo removed—an effect which may be aided by frequent changes of clean linen. The extreme veſſels are ſtimulated and cleanſed, by which means they are enabled to carry on more perfectly the excretions; perſpiration being one of the principal reſources of nature to expel the poiſon which enkindles the flame of peſtilence.—The whole ſyſtem is kept in equilibrio, by a diminution of excitement in the robuſt, and by an increaſe of it in the debilitated; the conſequence is, the ſyſtem is daily renewing its tone and vigour, the energy of the brain is preſerved, the muſcular fibres retain their powers, and all the functions of the body, the digeſtion, circulation, ſecretions, and evacuations, are regularly performed.

Medical gentlemen will excuſe me for theſe ideas, which belong more properly to their province. They are not new to that deſcription of citizens; but, if juſt, they ought to be univerſally known; for they lay the beſt foundation for a regular plan of economy in domeſtic life, which will greatly alleviate the diſtreſſes of autumnal epidemics. I cannot help thinking mankind are yet in their infancy in this reſpect; and that in general they underſtand the true art of living, which ſhall ſecure health and happineſs, as little as they underſtood agriculture, or naval architecture, in the days of Henry the Firſt.

I am perſuaded that the whole art of ſecuring ourſelves from peſtilence, as I have before remarked, conſiſts in this ſingle maxim—"Preſerve the natural energy of the ſyſtem." That water, freſh and pure, is the inſtrument moſt efficacious for this purpoſe, I muſt believe, from reaſon and experiment. The fact related by Volney of the eſcape of the water-carriers, is of infinite weight, if fairly ſtated, and demands immediate application to our own caſe. At any rate, it demands inveſtigation.

I have other proof of the ſucceſs of water, uſed as I have preſcribed. A friend of mine who has lived many years in the Weſt Indies, who has ſeen the yellow fever in all its forms, who has tended the ſick in that climate and in New York, expoſed himſelf to their breath and effluvia for days and nights,

nights, and ſlept with his own ſon when on his death-bed with that diſeaſe, has hitherto eſcaped the infection. He aſcribes this impunity to a daily uſe of water in the manner above mentioned.

We are not to calculate on the univerſal and invariable ſucceſs of any remedy for this terrible calamity. Multitudes of men will not take the pains to uſe the means neceſſary to reſiſt the effects of the numerous cauſes of diſeaſe which ſurround them. They will neither regulate their diet, nor cleanſe their perſons and habitations; and when to the influence of their own intemperance, and the poiſon generated in their houſes and on their bodies, is added the debilitating operation of peculiar ſeaſons, and other cauſes which are above human controul, great numbers of them muſt ſink and periſh.

Nor is it to be ſuppoſed that any human means can, in every caſe, guard life, in a peſtilential ſtate of air. If we admit *debility* to be the univerſal proximate cauſe of the plague, we are not ſure that our beſt efforts to obviate its effects will always ſucceed. We may not be able to find or to apply, in all caſes and under all circumſtances, the preciſe degree of ſtimulus neceſſary to preſerve the corporeal functions; and the variety of conſtitutions, and diverſe operations of the ſame remedies on different bodies, will defeat, in ſome

cafes, the moft exact application of the beft poffible fyftem.

Of one thing I am confident, that, in our cities, as now conftructed, no rigours of police can fo effectually cleanfe away the fources of poifon, as to prevent a return of peftilence, without the univerfal introduction of a new domeftic economy, and new modes of living. I am firmly perfuaded that fruitful fources of the evil lie in thefe two articles—the exceffive ufe of ftimulant food and liquors, and the neglect of perfonal wafhing. The diet of the Americans, like that of the Englifh, is of the moft nourifhing kind—a large portion of the beft flefh meats, and high-feafoned fifh and vegetables. Our drink is of the fame character—the beft high wines, fpirits, and brandy.

In winter our bodies fuftain this ftimulant mode of living; the extreme cold continually refifting its effects by its debilitating powers. But when fummer arrives, and the violent ftimulus of heat is added to the high ftimulus of the beft diet, two claffes of men fall a facrifice to violent fevers. Firft, men who pufh their ftimulus beyond the powers of nature, by exceffive exertion and intemperance in eating and drinking. Hence a robuft man riots in debauchery to-day, and four days after is in his grave. Secondly, men who live freely in winter and reduce their

diet too low in the ſummer, to avoid diſeaſes, inducing a weak, languid ſtate of the ſyſtem.

It muſt be obvious to any perſon in America, that the French mode of living, in regard to diet, drink, and the liberal uſe of water and the ſyringe, protects them from the epidemic diſeaſes which prey upon the Americans and Britiſh natives. Nor have I the leaſt doubt that a ſuitable regimen, purſued rigorouſly by the Europeans, would have ſaved one half of the people who periſhed in the black peſtilence in 1348.

Unfortunate ſouls! they believed the plague to be communicated by infection only; they ſought ſafety by flight; they embarked on board of veſſels, and launched out upon the ocean to *eſcape infection*; but all in vain: the diſeaſe attacked them in every ſituation, and the world was almoſt diſpeopled. Had they known that the diſtemper was induced ſolely by the debilitating qualities of the elements and the ſeaſon, what multitudes would have applied the true remedy and ſurvived! Thanks to a kind Providence, ſuch a ſingularly diſtreſſing ſtate of the air occurs ſcarcely in a century; but when it does, there is no flight from the ſources of diſeaſe, as in ordinary plagues, which ariſe in the impure atmoſphere of cities only; but men muſt have recourſe to the applications which reſiſt the effects of debility, and maintain the energy of the ſyſtem

by ſupplying the defective powers of the elements with artificial ſtimuli.

I cannot cloſe this ſection without a few remarks on the general plan of building large towns.

The ancient mode of conſtructing cities bears ſome characteriſtics of the age and taſte of the nations in which they were reſpectively founded. Moſt of the old cities were evidently built with reference to a ſtate of war and robbery, being intended for ſafety rather than for convenience; as appears by their narrow ſtreets, and the projections of the upper ſtories of the houſes. The more people could be crouded into a ſmall ſpace, the leſs military force was neceſſary to defend the town.

However this may be, thoſe cities were very ill conſtructed for the purpoſes of health. Savary aſſerts, that 200 perſons in Grand Cairo occupy leſs ſpace than thirty in Paris. The ſtreets are ſo narrow and full of people, that they joſtle againſt each other, and ſometimes a man is obliged to wait ſome minutes before he can make his way, Letter iii. Yet this ſame author alleges the plague to be *not native* in Egypt! Surely a man of ſcience need not go out of Cairo to look for cauſes of peſtilence.

Many ſtreets in Conſtantinople are narrow and crouded like thoſe in Cairo.

The old city of London, before the *fortunate* conflagration of 1666, was in a like predicament; its

its ſtreets narrow, and almoſt cloſed above by the jutting of the upper-ſtories of the houſes. In the old ſtreets, which eſcaped the fire, notwithſtanding all the improvements of modern days, which have mitigated the violence of peſtilential diſeaſes, I am informed people are ſtill infeſted with nervous and typhus fevers. London is however greatly indebted to the conflagration. In the preſent conſtruction of the buildings, *one* perſon, it is ſaid, occupies as much ground as two did before the fire. The ſize and arrangement of houſes and apartments are alſo improved, and better adapted to a free circulation of air. The introduction of freſh water may alſo be numbered amongſt the beſt preſervatives from diſeaſe. Theſe are among the cauſes of the non-appearance of the plague in modern London; and the diminution of the annual bills of mortality within the laſt half century.

The plague has however diſappeared in other cities of Europe, where no ſuch improvements have been made—a curious fact that will hereafter be conſidered.

But the diſeaſe continues to prevail occaſionally in the eaſtern parts of Europe, in Hungary, Poland, and Ruſſia, which were ſeverely ravaged in 1770 and 1771. The diſeaſe alſo raged at Oczakow, on the north border of the Euxine, as late as the year 1739.

That

That part of Europe abounds with marſhes and ſtagnant water, and conſiſts moſtly of level land. This may account for the continuance of the plague in that quarter.

The United States unfortunately contain ſimilar ſources of diſeaſe, in number and extent ſcarcely equalled. Yet, inſtead of profiting by ſevere diſtreſſes, which all great cities have ſuffered once in fifteen or twenty years from peſtilence, and guarding againſt the artificial cauſes of it, our anceſtors began, and we are continuing, to build cities on the Gothic plan, without more regard to the lives and happineſs of our citizens, than that which was manifeſted by the barbarians of antiquity: the moderns, however, proceed on the ſame plan, from a different motive, which is avarice. It is now the intereſt of the proprietors of lots in a city to which all the pleaſure of living, and the health of citizens, are ſacrificed.

We are preciſely in the latitudes moſt favourable to the production of peſtilence. In the tropical climates, conſtant heat ſoon fits the human body to ſuſtain it, and the *natives* of thoſe climates are ſeldom affected by the furious rage of epidemic peſtilential diſeaſes. Within the tropics *ſtrangers* alone are ſufferers by the climate*.

But

* Savary remarks, " That the plague ſeldom reaches the polar circle, and never paſſes the tropics. The caravans of Cairo, Damaſcus, and Iſpahan, which are ſometimes infected,

But in the temperate latitudes, men are continually ſubject to the alternations of extreme heat and cold—changes hoſtile to the ſyſtem.—In winter, we may be ſaid to be inhabitants of Lapland; in ſummer, of Mexico, or the Weſt Indies. If we do not remove to the polar circles, or to the tropics, yet the revolutions of the ſeaſons *bring their climates to us*—and we annually run a ſimilar riſk with the Europeans, who paſs from the northern to the ſouthern latitudes, and periſh in multitudes.

It is a moſt unqueſtionable fact, that the northern States of America, from New York to Maine, are in a poſition on the globe as expoſed to the plague as the cities of Marſeilles, Naples, Rome, and Conſtantinople; and the ſouthern States have a poſition correſponding with the latitude of Syria, the Barbary coaſt, and Egypt; that portion of the earth which is *moſt frequently* ravaged with peſtilential diſeaſes.

fected, never propagate it at Mecca, and Yemen is ſafe from the plague." With few exceptions theſe obſervations are juſt. If the natives of cool regions paſs ſuddenly into tropical climates, they are ſubject to violent fevers; but the reaſon aſſigned in the text is ſufficient to account for the perpetual exemption of *natives* of hot climates from the worſt form of peſtilence. Their bodies mould themſelves to the climate—their excitement or debility is always uniform. It is the great changes, in theſe reſpects, which expoſe people in the middle latitudes to the attacks of peſtilential diſeaſes.

If

If then we live in a climate in which the human body, from alternate heat and cold, is moſt irritable, and moſt ſubject to malignant autumnal diſtempers; and if a part of our country is peculiarly adapted to the production of ſuch diſeaſes, the moſt ſerious of all queſtions ariſes, what ſhall we do to prevent a frequent return of ſuch calamities?

To me the path is extremely plain. Our climate we cannot change—much of our country cannot be raiſed into hills, nor drained of its ſtagnant waters—the laws of nature we are unable to controul in their operation.—But our duty is plain.—Men muſt not plant their habitations near marſhy grounds—the mode of building cities *muſt* be totally changed—and ſo muſt the uſual habits of our citizens.

Throughout the whole Atlantic territory, on the low lands, it is more eſſential that large towns ſhould be purpoſely conſtructed for health.—Great cities are uſually founded on commerce, and commerce requires the acceſs of navigable water. Hence ſuch towns are commonly near the ſea ſhore, or on the borders of rivers.—But if they are near low marſhy grounds, they cannot be healthy. High and dry poſitions, with rocky or gravelly earth, are the proper places for populous cities, on account of freſh air and good water.

But in any ſituation our cities are too crouded for health or comfort. Lots are too ſmall.—Too many

many people are crouded on too little a ſpace of ground. A family to every lot of 25 or 30 feet by 80 or 100, cannot fail to generate too much filth, and to vitiate the air in too great a degree for the health of the citizens. In every large town in the United States, however remote from marſh, and however healthy its poſition, the effects of crouded population are obvious every autumn in the ſickneſs and death of *children*. Multitudes, and multitudes of lives are annually ſacrificed in all cities to the avarice of the original proprietors of lots. The little, narrow, dirty houſes, kitchens and yards, ſurrounded with high fences excluding air and vegetation; all that can diſſipate or abſorb the noxious exhalations; all that can purify the atmoſphere, and refreſh the exhauſted frame of a human being panting beneath a ſultry ſun. Every thing in our cities is contrived to *waſte the powers of life and ſhorten its duration.*

Men, in this reſpect, are infinitely leſs ſagacious than irrational animals.—Inſtinct guides the beaſts of the field to the moſt proper habitations, and they never reſide where they are *annoyed*. But man, with all his boaſted reaſon, ſees the effects of his folly, and hundreds and thouſands of his fellow-citizens falling victims to his own neglect, his miſtakes, or his ſordid principles: he heaves a ſigh in Auguſt and September as he views the ſable hearſe conveying his friends, in ſcores, to their graves: in November he ſhrugs his ſhoul-

ders,

ders, and ſays, *it is all over*; runs to the circus, the theatre and card-room; laughs away the winter's evening with his jovial companions, ſome of whom are deſtined, the next ſeaſon, to fall a ſacrifice to the ſame folly and neglect, and to fill new ranges of graves by the ſide of the victims of the preceding year.

In the United States, every thing that has been done hitherto in the conſtruction of cities, is in imitation of the old European and African mode, and of courſe is wrong.

The ancient conſtruction of London coſt that city nearly *two hundred thouſand lives* in one century; and Cairo and Conſtantinople, probably loſe more than that number every half century. I firmly believe, and my belief is founded on the uniform operation of eſtabliſhed laws of nature, that *a perſeverance in our preſent mode of building cities will doom them all to the ſame fate.*—I believe it, becauſe I ſee no poſſible reaſon why peſtilential diſeaſes ſhould not be as frequent and as fatal in America as in the old World, under the operation of ſimilar local cauſes.

If a rigid policy can be uniformly obſerved, and every poſſible nuiſance be removed by ſhovels, brooms, and water, cities, in healthy poſitions, will eſcape the regular and conſtant return of malignant epidemics. Multitudes of lives may be ſaved, and the loſs of buſineſs prevented by theſe means: and in cities already built, cleanſing,

waſhing,

washing, and purifying, are the guardian angels of public health.

But, I maintain, that this is not exterminating the root of the evil.—Cities *may* be built so as to unite all the utility of a town with the salubrity and pleasures of the country; and in this new world, where men are as free to act as to think, it will be dishonourable not to invent and execute a plan for these purposes.

Were I called on for a plan of a city which should combine in it the advantages of town and country, I should suggest the following as the outline:

1. The position to be on the shore of the sea, or the bank of a river, gently ascending with an angle at least of fifteen or twenty degrees, which would form a declivity for a rapid descent of water to wash the city, at the same time would not prevent the draft of heavy loads from the river or ocean.

2. The wharfs on the water should be extended beyond low water mark, that no part of the docks should be left bare by the recess of the tide. All the solid front of the wharfs should be in a line that no eddies might be formed, and the water might flow in a passing current. This would carry off substances thrown into the water, and contribute to keep the air pure by motion and change. Should it be necessary to extend wharfing in

in one place further than in another, it ſhould be in the form of a bridge on piers.

3. The warehouſes on the wharfs ſhould not be jumbled together in a chaos projecting in front of one another; but built in a ſtrait range at a ſuitable diſtance from the water; and an alley ſhould paſs between them for the admiſſion of freſh air on every ſide. No wet cellars ſhould be permitted.

4. The ſtreets ſhould be ſtrait, interſecting each other at right angles, and forming the city into ſquares of 500 feet on a ſide.

5. The lot ſhould be at leaſt 60 feet wide, and 250 feet long. No more than 35, or, at moſt, 40 feet of the breadth of the lot to be ever covered with buildings, ſo that a ſpace of 20 or 25 feet ſhould intervene between the houſes. This ſpace would leave a cartway, give free admiſſion to air, and reduce the riſk of fire 75 per cent.

6. In the rear of the front building out-houſes might cover 100 feet of the length of the lot; the remaining 150 feet ſhould be laid out to the fancy of the owner in a garden.—The police interfering no farther than to require, by law, that ſome kind of trees or vegetables ſhould occupy the ſpace,—vegetation being the natural purifier of the air.

7. Directly through the centre of each ſquare ſhould run a narrow ſtreet of about 25 feet, taken out of the rear of the lots, which ſtreet or alley ſhould

ſhould never be built on, but would admit a paſſage for citizens through the ſquares, and what would be ſtill more neceſſary and uſeful, would admit duſt carts to take up all the filth of the houſes from the rear, and prevent that intolerable nuiſance, the depoſiting of offenſive materials in the ſtreets. The little flower gardens and ſhady lawns in theſe ſquares would preſerve the air pure, freſh, and cool in ſummer; they would occupy many perſons of delicate health, thus contributing to their comfort, diverting their minds, and, in many caſes, reſtoring them to health. Here, alſo, children would find room to gambol without endangering their lives, or annoying paſſengers in the ſtreets; and here the young of both ſexes could acquire a taſte for gardening, for botany, and the delightful amuſement of ſtudying the works of nature.

8. The ſtreets ſhould be 100 feet in breadth, and planted with three rows of trees; one row on each ſide next the foot walks, and a row in the centre.—The foot walks to be 15 feet wide; the trees next the walks would then be 15 feet from the houſes, and a ſpace between the centre row and each ſide row of 35 feet. The trees might be ſo pruned as to prevent their injuring the buildings, and their diſtance would prevent their interfering with fire-engines: theſe trees would be leafleſs in winter when the ſun is acceptable, and in ſummer would ſweeten, purify and cool the air.

air. The citizens at all times in the day would walk in a refreſhing ſhade.—The centre row of trees would furniſh ſhade for horſes.

9. No city ſhould be raiſed on level earth. If a natural poſition can be found, with a general declivity to the water, the ſtreets ſhould be thrown into artificial elevations of, at leaſt, three feet in every hundred,—five feet in the hundred would be better:—this would give celerity to the water falling in ſhowers, and wonderfully aſſiſt in removing filthy ſubſtances from the ſtreets; for after all human efforts in ſweeping, much offenſive matter will remain, which water alone will reach and carry off.

10. No pains ſhould be ſpared to ſupply a city with freſh running water.

It is a point of infinite importance, that citizens ſhould not depend on water from pumps in the city. In a few years the ſubterranean water becomes impregnated with the noxious particles from vaults, and this evil continues to increaſe with the age of the city. One of two remedies is to be provided—either the city muſt be ſupplied with freſh water by pipes from a diſtant ſource, or the vaults muſt be ſo formed as to be capable of being opened in winter and cleanſed. But the laſt method, though uſeful and practiſed in ſome European cities, would be ineffectual.

The back houſes in a city are, in many reſpects, a terrible nuiſance. If a ſewer could be carried

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four or five feet under ground, and every ſuch houſe ſet over it, a ſtream of water paſſing through it from a diſtant ſource would be an excellent means of cleanſing a city from this ſource of diſeaſe: but ſuch ſtreams of water are rarely to be obtained.—Another expedient ſuggeſts itſelf for the ſame purpoſe:—Let a ſewer of three feet wide, and well paved, be run in a ſtraight line under the rear of the lots, and all back houſes ſet over it. In ſuitable places let channels be made to turn the water from the ſtreets into the ſewers, in long or violent ſhowers, when the water is not wanted to waſh the ſtreets. In this manner the ſewers might be waſhed perfectly clean a number of times every ſummer, and the citizens preſerved from their poiſonous exhalations.

On a model of this kind, I conceive cities ſhould be conſtructed in the *moſt healthy* ſituations, for a crouded population in any place on earth will leſſen the ſalubrity of the air. Cloſe, compact cities, in any quarter of the globe, are the graves of men. All the great cities of Europe require annually ſome thouſands of ſtrangers to ſupply their waſte of population: yet there is no neceſſity for men to croud together in ſuch a compact form. There is land enough on earth to ſuffer any extenſion of cities, and it makes little difference, in the firſt inſtance, whether a lot contains one hundred feet of land or half an acre: nor would a leſs denſe population be any incon-

 venience

venience to men in bufinefs: they might be obliged to walk further on fome occafions, but in the cool fhade of my propofed city this would be a pleafure rather than a toil.

It is wrong, it is criminal, for legiflatures to permit fuch crowded population. It is a nuifance, not only to cities, but to the public.—It is a truth, that numbers of lives are facrificed almoft every year among worthy country gentlemen, who have bufinefs in our large cities.

They come to town in the hot feafon, when no uncommon difeafe prevails among the citizens who are inured to the air:—they come without fufpicion:—they are feized with fever, and die. The air of the low grounds in our cities, even in healthy feafons, is often poifon to the people in the country, and gives them a fever when no epidemic is vifible among the citizens.—I know the fact, and it is a ferious calamity, efpecially to feamen. The low grounds in Providence, New-York, Baltimore, &c. are great nuifances.—The building of Water-ftreet and Front-ftreet, in New-York, it is believed by good judges, has coft this city a thoufand lives in five or fix years.—I fay nothing of Philadelphia, for its pofition, and the alterations in the original plan of the city have doomed it to calamity.—The citizens will not believe the evil to arife among themfelves, and therefore muft be left to their fate.—If remitting fevers *every* year, and yellow fever *often*, will not convince

convince men that ſomething is wrong in *their* city, it is in vain to reaſon with them.—Of one thing I am confident, that if all the earth in New-York on which Water and Front ſtreets are built, could be ſunk 30 feet under water without loſs of lives, and the proprietors indemnified by the citizens, it would be the greateſt bleſſing which heaven could in mercy beſtow on the city and the State. I believe, alſo, that if all the croſs ſtreets, and the back houſes in Philadelphia could be levelled with the earth, and the ground converted into flower gardens and graſs plats, the citizens would, in twenty years, celebrate the anniverſary of their deſtruction with as much fervour as the republicans in France celebrate the demolition of the Baſtile.

It is not poſſible, I ſpeak in zeal and confidence, it is not poſſible, under the operation of the *preſent* laws of nature, for men to be healthy in many of our cities during the heat of ſummer. That open champaign country, which regularly produces intermitting and remitting fevers, will, when planted with populous cities, often produce the plague. Of that country there is an extent in the United States, of more than 1000 miles in length, and from 40 to 60 in breadth.

All the ſhore of the Atlantic, from the Hudſon north-eaſtward, will admit of healthy cities. If the commercial towns on that portion of America were conſtructed on the foregoing plan, I would anſwer

for it, that they would never be ravaged with yellow fever: Individual cafes might occur, but the difeafe could not, without a miracle, become epidemic. But as our towns are now built, they will at times be partially affected. In *ordinary* feafons, and with a vigilant police, they will efcape with the yearly lofs of only ten, fifteen, or, perhaps, fifty citizens, the unfortunate victims of the negligence, the folly, and the crowded population of cities. In very *unfavourable feafons* the number of victims will be *increafed.—Such is the fate of our northern cities.*—But the deftiny of cities on the fouthern Atlantic fhore is to be more fevere.

The period of general contagion may fubfide, and intervals of more general public health, may be expected. The moft unhealthy parts of the earth enjoy fuch intervals, when the rage of malignant complaints is fufpended; but melancholy periods of epidemics will often recur—and as the plague, in all its fhapes, is the offspring of *caufes,* mankind, wherever thofe caufes exift, are deftined to be afflicted.

Away then with crowded cities—the thirty feet lots and alleys—the artificial refervoirs of filth—the hot-beds of atmofpheric poifon. Such are our cities—they are great prifons, built with immenfe labour to breed infection and hurry mankind prematurely to the grave.

There is no neceffity for this deftruction of human life. Cities laid out on my plan would

unite

unite all the pleaſures of country villages, rural ſeats, and commercial towns. The merchant, in his ordinary buſineſs, would enjoy the grateful ſhade of oaks and elms, with the luxuriant perfumes of odoriferous flowers. At the ſame time, this verdant city would ſuperſede the uſe of ſolitary country-ſeats in ſummer, and thus ſave the expence now incurred of poſſeſſing a town and country houſe. The country ſeat of a merchant, is a tax of ten, fifteen, or twenty thouſand dollars, paid to maintain the poiſon and peſtilence of our preſent cities.

It is remarked by Boyle and other authors, that China is rarely affected with the plague. The peſtilence of 1347 is ſaid to have commenced in that country; but it ſeems to be agreed, that China and ſome other Aſiatic countries are not often affected. This fact, if juſt, deſerves inveſtigation; in particular, ought philoſophers to examine the nature and properties of the ſoil, and the mineral productions.

China is a very populous country, filled with canals, and well cultivated. It is probable that the water in their canals is never ſtagnant, nor filled with vegetables—it is probable that the face of the country has been completely dried by cultivation, all ſwamps and moiſt grounds drained and covered with corn, rice, and graſs. How much theſe improvements have contributed to

 preſerve

preſerve its inhabitants from peſtilence, I need not inform my readers.

The cities alſo in China are vaſtly large and populous; and an enquiry will ariſe, how thoſe cities eſcape the plague, if great population contributes ſo much to the calamity.

I anſwer, they do not eſcape all plagues—ſome of the moſt violent have ravaged China, but they probably eſcape the ſlighter plagues, which are the moſt frequent; and this is all that mankind can expect.

We are not ſufficiently acquainted with the ſoil, climate, police, and manners of China, to ſpeak with certainty on the ſubject; but one fact ought to be mentioned. The Chineſe houſes have no windows in front on the ſtreet, but in the rear, are ſpacious gardens filled with trees, vegetables, flowers and freſh ſtreams of water. Here the family is regaled and amuſed; the air is rendered pure by cultivation, cleanlineſs, and the particles exhaled from growing plants, and waterfalls. This arrangement alone will account for their exemption from the uſual diſeaſes of hot climates. When the Americans, with their boaſted light and ſcience, ſhall become as wiſe as the Chineſe, they may expect to ſhare in the exemption.

It is a fact related by Ruſſel and others, that in the midſt of the Turkiſh cities, during a deſolating plague, the ſpacious manſions of the

wealthy Turks, which are kept clean and well aired, often eſcape the diſeaſe.

I cannot leave this deeply intereſting ſubject, without relating an anecdote from antiquity, which ſhews in what light wiſe men formerly viewed it.

In Greece the countries of Attica and Lacedemon conſiſt of dry, gravelly or rocky land; and I can find but one inſtance in which they were afflicted by peſtilence, in early ages. It is evident from Thucydides, that the plague had never been known in Athens, before his time, ſince the date of the earlieſt traditions, and then it was probably induced principally by the crowd of people collected in the ſiege, to eſcape the ravages of the Lacedemonians.

Beotia, on the contrary, was more frequently viſited by peſtilence. To account for this, let us know what was the ſituation of this country—it is thus deſcribed:

Beotia may be conſidered as a large baſon, ſurrounded by mountains, the different chains of which are connected by high grounds. Moſt of the rivers from theſe hills unite in lake Copais, of fourteen leagues circumference, which has no apparent outlet, but which, it was alleged by the ancients, had ſubterranean paſſages to the ſea.—The country is not without hills; but is moſtly level, and very fruitful. The air in Attica is remarkably pure; but in Beotia, very denſe; hence the

the ancients derived the heavy phlegmatic character of the inhabitants from the air. This country ſeems to have been to Attica what Holland now is to France.

See Travels of Anacharſis, ch. 34, and the authorities there cited.

From ſeveral paſſages of Hiſtory, it appears that Beotia was more frequently viſited by peſtilence, than Attica—this we ſhould expect from the difference of their ſituations.

Juſtin, lib. 16. ca. 3. informs us, that the Beotians once conſulted the Delphic Oracle how to remedy the plague which troubled their country. The Oracle replied, "that they muſt plant a colony in the country of Pontus, ſacred to Hercules;"—but they were ſo much attached to their own country, that they diſobeyed the injunction; until another calamity, war, drove them to conſult the Oracle a ſecond time, when, receiving a ſimilar anſwer, a part of the people removed to the borders of the Euxine, and planted the famous city of Herculea.

This Oracle certainly underſtood the cauſe of the evil, and directed to a ſuitable remedy. The anſwer implies, "you muſt thin your population—or "you muſt ſeek a more ſalubrious climate;" or it might include both of theſe ideas. The direction is full of wiſdom, and is ſtrictly applicable to many of our American cities. Tranſlated into

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the language of our circumſtances, it runs thus: "Thin your population, by ſpreading your citizens over a larger extent of ground, or you muſt be driven from your cities, or you muſt periſh by the plague."

We have "Moſes and the prophets" in books and experience, and if we will not liſten to them, neither the Delphic Oracle, nor a meſſenger from the thouſands of dead who have periſhed by the plagues of our cities, would induce belief or effect a reformation.

SECTION XVIII.

Of the Disappearance of the Plague in some Parts of Europe, and of new Diseases.

IT is a common remark, that no plague has appeared in England since the year 1665, and that the disorder has ceased in the west of Europe for near a century past. This happy exemption from that horrible calamity has been ascribed to various causes. Many people ascribe it to health-laws, a subject that has been discussed. Some allege that the use of fossil coal has banished the plague from London; and Hoffman relates, that Halle, in Germany, which used to be afflicted with malignant fevers, has been free from them since coal has been used as fuel. Others suppose, that the great improvements in building and in the modes of living, in modern times, have been the means of preventing the return of pestilence.

On the first cause I have already given my opinion, and the reasons on which it is founded. I find no sufficient evidence that health-laws ever saved a country or city from pestilence, in a single instance, but abundant positive proof of their utter inefficacy in a great number of cases.

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With respect to the use of coal, we ought not to indulge very sanguine expectations. It may be true, that violent diseases became more rare, or wholly disappeared, in some places, about the time that coal became of general use as fuel. But let us examine facts, and not trust to general cursory observations.

The digging of coal, at Newcastle, for fuel, commenced as early as the year 1234, as appears by a charter of Henry III. and how much earlier is not known. It was used in London as early as 1379, in considerable quantities, but when first introduced does not appear. In 1550 coal was in common use in London, its price "twelve shillings a load." The price in 1590 was raised to "nine shillings a chaldron," which was deemed exorbitant. Thus far we have little light on the subject; but in 1615, the coal trade occupied four hundred ships; *two hundred* of which were employed between London and Newcastle. The present number is *five hundred*, and London contains more than double the inhabitants it did at that time.

See Anderson's Com. vol. i. and Fleetwood's Chron.

In 1615, then, the use of coal must have been general in London, and for some time before, for the growth of the trade must have been gradual. But for fifty years, after this general use of coal, London was afflicted with the plague; the city indeed

indeed was rarely free from it, as appears by the Bills of Mortality; and three times after that period the city was ravaged by that diſtemper, as an epidemic, viz. in 1625, 1636, and 1665.

So far we have no encouragement to hope for a prevention of the plague by the uſe of coal. With reſpect to the city of Halle I can ſay nothing. The obſervation of Hoffman may be juſt; yet coal may have had no influence in checking the prevalence of peſtilence.

It belongs to phyſicians to aſcertain the effect of the vapour from this foſſil ſubſtance on human health; certain it is, that it occaſions inconveniences to thoſe who are not accuſtomed to it. So general was the prejudice againſt it, when firſt uſed in London, that in the year 1400, the nobility and citizens petitioned the King "to prohibit the further uſe of ſo noxious and unhealthy a kind of fuel."

And. Com. vol. 6, ap. 935.

There is reaſon to believe it is not very unhealthy, but I ſee no ground to ſuppoſe it has had the leaſt influence in arreſting the progreſs, or preventing the return of the plague.

To confirm this opinion, I would mention that the plague diſappeared in France and other parts of Europe about the time it did in England; in Paris, for inſtance, where no coal is uſed. In a great part of Europe therefore the

the ſame effect has taken place without the ſuppoſed cauſe, which leaves us at liberty to reject that cauſe.

The third reaſon aſſigned for the ceſſation of the plague, viz. improvements in building houſes and cities, and in clothing, diet, the uſe of freſh water, and the like, is a juſt one; and there can be no rational doubt that theſe alterations have contributed to mitigate the violence and reſtrain the progreſs of many acute diſeaſes. Peſtilential epidemics are probably leſs frequent within the laſt century, at leaſt in the more civilized and commercial parts of Europe, and alſo in America, than they had been in former periods.

The poverty, the filth, the dirty crouded mud cottages, and the ſcanty ſupply of wholeſome food, which was the common fare of the peaſantry in Europe, muſt have given origin or currency to many diſeaſes, and greatly aggravated their ſeverity. A ſample of this may be ſeen in the early appearance of mortal *diſeaſes* in the low narrow ſtreets and ſmall crowded apartments, now occupied by the poorer people in our cities, and the difficulty of expelling a peſtilential diſeaſe from ſuch places.*

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* The following extracts will ſhow the ſtate of cities and the manners at the periods mentioned:

" Weſtminſter and London were once above a mile aſunder. The Union with Scotland, in 1603, did not a little

As a general remark, it may be alleged, with great probability that Europe has derived no ſmall benefit, in regard to public health, from the following circumſtances.

Firſt, From the modern improvements in agriculture, by which means many places are dried and ſweetened which uſed to be cold, damp, and fetid.

Agriculture not only removes from the earth ſubſtances poſitively noxious to health, but covers its ſurface with growing vegetables poſitively ſalubrious. This is one inſtance, of multitudes in the œconomy of the world, in which

little conduce to make a union of London and Weſtminſter; for the Scots greatly multiplying here, *neſtled themſelves about the Court*, ſo that the Strand, from *the mud walls* and *thatched houſes*, acquired that perfection of buildings it now poſſeſſes."

And. Com. vol. ii. 285. from Howel.

Voltaire ſays, about the year 1500, "Induſtry had not yet changed thoſe *huts of wood* and *plaiſter*, of which Paris was compoſed, into ſumptuous palaces. London was ſtill worſe built, and Peers of the realm carried their wives behind them on horſeback."

In 1504, when James IV. of Scotland was married to Margaret, daughter of Henry VII. of England, the Princeſs made her public entry into Edinburgh riding behind King James on a pillion.

Henry's Hiſt. Britain, vol. vi. 597.

This *princely* cuſtom is ſtill preſerved in New England, where the common farmers live in better houſes than many of the nobles at the period above named.

which the happineſs, comfort, and intereſt of man are made to depend on his induſtry.

See Dr. Ruſh's Works, vol. i. p. 25.

Secondly, Improvements in building houſes may have contributed to the ſame ſalutary end. The materials are of a kind leſs ſuſceptible of accumulating and retaining infectious exhalations than formerly; and the apartments are more ſpacious, elevated and airy.

Thirdly, Houſes are leſs crowded than in ancient times, as appears by the proclamation of Queen Elizabeth, recited in the foregoing hiſtory. In London one perſon, ſince the fire of 1666, is ſuppoſed to occupy as much ſpace as two in the old city. This remark applies eſpecially to the poor, who were formerly more numerous than at preſent. Some of the nobles in the old city had ſpacious gardens; but the maſs of people were univerſally poor, and crowded into narrow filthy lodgings.

Fourthly, There is probably an immenſe difference, in regard to general cleanlineſs, between the people even of the ſixteenth century and the preſent age. For this we are partly indebted to commerce, the ſource of wealth and refinement. A more general uſe of linen and cotton in clothing, articles which require waſhing frequently, may have contributed to the ſame effect.

 Fifthly,

Fifthly, The introduction of pure water into cities from distant sources, and a liberal use of it in houses and the streets, have aided in the same salutary work of diminishing the calamities of disease.

Sixthly, t is believed that the modern diet is more friendly to health than that of former times. It is evident, that to this change Europe is much indebted for the disappearance of scorbutic complaints, which formerly were epidemic in Holland and other parts; and which still prevail in Iceland and Canada, where the poor live mostly on dried or salted fish, poor flesh meats, with a small portion of vegetables. The cultivation of the vine and the orchard has, doubtless, had a considerable effect. Cyder and wine have assisted in preserving the body from debility in certain pestilential periods; and when temperately used are of excellent use.

But while I admit that the true plague has disappeared as an epidemic in many parts of Europe, I do not admit that *pestilence*, in the general sense of the word, has wholly disappeared. If the true plague, technically so called, should never again occur in London or Paris, I should then say, that improvements in modern times may have *mitigated* the *pestilence*, but not that they have wholly banished it. Under this word *pestilence* I include small-pox, anginas, and petechial fever, with ma-

malignant diſorders, which evidently depend on the ſame general cauſe as the real plague, operating in a different manner, or with leſs force. Theſe diſeaſes ſtill appear in all parts of Europe, and exhibit the *exiſtence of the peſtilential principle*, although improvements may have *leſſened* and *circumſcribed* its effects.

I do not, however, conſider it as certain, that the true plague will not reviſit all the weſtern parts of Europe. A concurrence of cauſes, like that in 1348, might again produce that diſeaſe in France, England, and Ireland, with all its horrors. But the probability is, that the modern improvements have removed ſo many of the *local cauſes* of diſeaſe, that no conſtitution of air will ever again produce the ſame mortality as that under Vortigern, or that under Edward III. nor will the plague ever again be ſo frequent as in former ages.

On this point, however, there is not ſufficient ground to build any certain calculations, for the following reaſons:—Every phyſician and hiſtorian well knows that there have been frequent revolutions or changes in the form of certain diſeaſes; ordinary diſeaſes with new ſymptoms, and diſeaſes before unknown, have appeared in various countries, and in all periods.

The moſt remarkable of theſe are the ſmall-pox, venereal diſeaſe, ſweating ſickneſs, Hungarian

garian fever, petechial and angina maligna, with ſome of leſs note.

I am not about to enter on the great queſtion, when or how particular diſeaſes have been introduced or modified in their ſymptoms. I ſuſpect, however, there is a fallacy in the common theory about *new* diſeaſes. What are uſually called *new* are more probably nothing more than changes that are made in former diſeaſes, by alterations in the atmoſphere, climate, habits of living, and a multitude of inferior cauſes. The ſmall-pox and the venereal diſeaſe ſeem to have the beſt claim to the appellation of *new;* yet the fact of their being unknown before the periods aſſigned for their appearance, has been juſtly called in queſtion.

See *note* at the end of this ſection.

Certain diſeaſes, however, appear in particular countries, where they had not before been known ſince the date of the earlieſt hiſtories. Poſſibly ſome have been propagated by infection; others have evidently ariſen from ſome general cauſe. Thus Pliny relates that the Elephantiaſis was brought from Egypt into Italy by Pompey's troops, but ſoon diſappeared. It is ſaid alſo, that the ſame diſeaſe was propagated in the Weſt of Europe by the Cruſaders. Epidemic ſcurvy appeared in the maritime parts of Holland in

1556.

1556. The petechial fever which desolated Spain in 1557, and afterwards all Europe, was called a *new* disease, different from the usual purple fever said to be spread from the islands of the Levant through Italy to the West of Europe. The angina maligna in Spain in 1610, was called there a *new* disease; and in England, where it appeared about fifty years ago, it has been called a *new* disease in that country.

But the real state of the question seems to be epidemic diseases, most or all of which proceed from qualities of the air, suffer general changes in conformity with the revolutions and alterations which take place in the physical world. A remarkable instance of this was the Sudor Anglicus, which was, in its general symptoms, the plague; but some general cause in England first, and afterwards on the continent, superadded a peculiar symptom, that of profuse discharges by the pores. This character of the disease, as has been well observed by the author of *Traité de la peste*, was the effect of a species of revolution in the form of pestilence. Infection or contagion can have had no concern in producing this phenomenon. The disease maintained this peculiar character from 1483 to 1551, a period of almost seventy years, raging occasionally in most parts of Europe, and then disappeared; at least it has never made considerable ravages since that time.

This, in medical language, was a new diſeaſe, as demanding new modes of treatment; but, in the language of philoſophy, it was only a varied form of the ſame malady, and proceeding from a common cauſe with the inguinal plague; but that cauſe, in particular times and places, was modified in its operation.

What confirms this idea is, that this ſweating diſeaſe never appeared as an iſolated epidemic, but was always contemporary with the common plague in other countries; that is, it formed a part of the general effects of the peſtilential principle. Thus in 1483, about the time of its firſt occurrence in England, all Europe was deſolated by the common plague. Denmark loſt half of its inhabitants, and many other countries fared very little better. The ſame may be obſerved of its ſubſequent returns, and of its prevalence in Ireland, Holland, France, and Germany. This is what I call a revolution in peſtilence, and it will apply to many other changes in the predominant diſeaſes of the human race *.

Thus

* It aſtoniſhes me to read in modern books the poſitive aſſertions, "that the plague is never generated in Great Britain, or other northern latitudes." See Mead, James's Medical Dictionary, Cullen, Encyclopedia, and other original works and compilations without number. Lord Verulam, Sir Thomas Moore, Boyle, Eraſmus, Diemerbroeck, and other luminaries of former centuries, who ſaw the plague frequently

Thus the petechial fever. which ravaged Europe in the sixteenth century was called a *new* disease; but I conceive it to have been no more than a varied form of the common purple fever, induced by some general variation in the elemental cause of epidemics, or by the seasons. It formed a part of the pestilential series, and was the precursor of the plague, as it is to this day, although it has rarely been so general or fatal as about the year 1556, and from 1570 to 1576.

It is remarkable also, that the general cause extended over the Atlantic, and gave the same character to the fevers of the West Indies. The disease which reduced the forces of Sir Francis Drake at Carthagena in 1586, was called calenture; a species of malignant spotted fever.

Purchas. vol. iv. 1182.

A similar fever infected the people under Sir Thomas Gates, bound to Virginia, in the begin-

frequently in all its varieties, never pretended that the disease was not produced in their respective countries. The Sudor Anglicus, not only appeared *first* in England, but for the first time of its prevalence was confined to Englishmen. Yet this was the most violent and destructive form of the plague that ever has been known.

" *Nuper novum pestilentiæ genus immisit Deus, letiferum sudorem, quod* a Britannis exortum, *incredibili celeritate per orbem longe lateque divagatum est—plurimum exitio, summo terrore omnium.*"

Life of Erasmus, 347.

How respectable writers can overlook such authorities, is to me inexplicable.

ning of the laſt century. And if Ulloa is correct in ſtating that the infectious yellow fever never appeared at Carthagena till about the year 1730, we have a remarkable proof of a revolution in the diſeaſes of that climate. We are to conclude, from the facts, that the calenture was a diſtinct form of the peſtilence incident to the country till the beginning of the preſent century; ſince which it has aſſumed the character of our bilious plague. I am, however, inclined to queſtion the fact. Certain it is, that the true yellow fever has been known in the Engliſh iſlands from their firſt ſettlement. It reduced Cromwell's forces when they firſt took Jamaica in 1655. It is further to be obſerved, that the true form of plague is never known in Spaniſh America. But at Quieto, and other places, malignant diſtempers, under the name of *ſpotted* fevers and pleuriſies, ſweep away prodigious numbers of people, and fall but little ſhort of the inguinal plague.

Ulloa, vol. i. 279, 281.

Such then is the peſtilence of South America; but in other periods it may take a different form.

Theſe obſervations alſo lead to an explanation of the phenomena of the angina maligna. It was called a *new* diſeaſe in Spain and England, when it firſt appeared in 1610; but this is a miſtake.

It

It is evidently defcribed as epidemic a century or two before thofe periods. But the truth is, *that form* of peftilence had difappeared for a long period, and given way to fome other difeafe. After a time it re-appeared, perhaps with fome new fymptoms.

The fame remarks apply to the Hungarian fever, the peculiar fymptoms of which firft occurred in the fixteenth century; and to a multitude of local and temporary epidemics which have been called, on account of fome fingular fymptoms, *new* difeafes.

Thefe facts ferve to explain my idea of the difappearance of the plague in certain parts of Europe. I confider the angina maligna as peftilence of the worft kind; and its occurrence in modern times, fince the glandular plague is lefs frequent, may be only one of the revolutions in difeafes of a malignant type which have marked other periods. The deftructive force of the peftilential principle falls principally upon the throat inftead of the brain or the glands, and moftly upon youth. This may be the principal form of peftilence for a century or two, when it may difappear and give way to the common plague, or to fome new combination of fymptoms which fhall pafs for a *new* difeafe. A conjecture of this kind is authorized by feveral changes in the general characters of difeafes at particular periods of the world. I do not therefore confider it to be *certain*, that the

parts

parts of Europe which have eſcaped the plague for a century are ſecure of permanent exemption from that calamity.

This conjecture ſeems to be authorized by the evident mitigation of the plague in the Levant within a century. Plagues are obviouſly leſs frequent and leſs ſevere in Egypt and Turkey than they were in former ages. This remark I believe to be new, but it is a fact; and this mitigation correſponds in time with the diſappearance of the diſeaſe in the healthy parts of Europe. From this circumſtance I conclude that this change is the effect of ſome general cauſe in the ſtate of the elements.

This opinion may derive great ſtrength from revolutions or changes in the natural world, analagous to that in the character of epidemic diſeaſes.

It is generally ſuppoſed by philoſophers, that earthquakes are leſs frequent and violent in modern days than in the firſt centuries after the chriſtian æra, and the imperfect ſurvey I have taken of their hiſtory, gives me reaſon to believe the opinion well-founded.

The eruption of volcanoes is very often ſuſpended for a long period. Etna was quiet about forty-five years at the beginning of the preſent century. The volcanic mountain in Teneriffe, which had been quiet ever ſince the year 1704, again diſcharged its fires in Auguſt laſt, after a ſuſpenſion of ninety-four years. There are other

volcanic mountains that have ſlumbered for many centuries, as Lipari near Sicily.

The aurora borealis has its revolutions. Sometimes it diſappears for half a century or more; then returns, and frequently illuminates the heavens.

The ſeaſons on a ſmaller ſcale manifeſt analogous revolutions. At certain periods we have mild winters, very little froſt and ſnow, with ſoutherly winds for a ſeries of years. Then we have a number of long ſeverely cold winters in ſucceſſion, with violent tempeſts, deep ſnow, and perpetual north weſterly winds. No leſs various are our ſummers as to heat and moiſture.

The vegetable kingdom exhibits ſimilar changes, for which no viſible cauſe can be aſſigned. When our anceſtors firſt ſettled Maſſachuſetts, they raiſed wheat on the eaſtern coaſt in the counties of Plymouth, Middleſex and Eſſex; but in the year 1664 mildew appeared for the firſt time to injure that uſeful article; and ſince that time it has not been poſſible to raiſe wheat within a conſiderable diſtance from the ſea ſhore.

It is related by the French that wheat had not been known to mildew in France until the year 1550. Van Helmont, p. 1093. In 1770 the potatoe plant in a particular part of Scotland was attacked by a diſeaſe which was *new*; and it has ſince been ſpreading. A ſimilar fact is related of the oats in ſome parts of the ſame country in 1775.

These

Theſe diſeaſes, for they are really ſuch among vegetables, are *new*; and, as far as they extend, they are a ſerious calamity. They are the peſtilences incident to vegetable life; which, like diſeaſes among men, ſpring up and diſappear without any certain cauſes which are within our comprehenſion. It is cuſtomary to aſcribe ſuch phenomena to the *ſeaſons*; but it would be difficult to find any *viſible* or *comprehenſible* qualities in the particular ſeaſons, producing ſuch diſeaſes among vegetables which had not characterized innumerable ſeaſons in former years which produced *no* ſuch effects.

The death of prim and black thorn in our country is a ſimilar phenomenon.

Sometimes a new ſpecies of tree will ſpring up ſpontaneouſly, and gradually ſpread where none ever grew before. The pine has thus introduced itſelf into Duxborough in Maſſachuſetts within the preſent century. Not twenty years ago, a man was living there who remembered the firſt white pine that ever grew in that town; but now one eighth part of the wood-land is covered with it.

Hiſt. Col. vol. ii. 5.

The animal world diſplays ſimilar changes and revolutions. We obſerve not only uncommon numbers of common inſects or ſmall animals in particular years, for which we can aſſign no ſpecific cauſe; but we actually ſee certain new ſpecies of inſects, and, at times, known in-

ſects grow to an uncommon ſize. Inſtances of the latter phenomena have occurred in the locuſts, in the frog kind, and in flies. The flies about Plymouth in 1633, and about New-London the laſt ſummer, are deſcribed as being not only diſtinguiſhable for their numbers, but for their ſize. Ancient authors have remarked the ſame phenomenon.

The millions of worms which ſpread over many hundred miles of territory in America in 1770, can no more be accounted for than the Sudor Anglicus, or any other new form of diſeaſe.

The inſect which about twenty years ago firſt appeared among the wheat on Staten Iſland, and which has continued to multiply and eſſentially injure the crops over a great extent of country, is unqueſtionably a non-deſcript as to America; a new form of animal life. Men are fond of propagating conjectures and vulgar tales for truth. The idle ſtory which imported this inſect from Germany, and gave it the name of Heſſian fly, has been proved, by careful enquiries, to be mere conjecture, no ſuch animal being known in Germany. Yet it has laid the foundation of a durable error in natural hiſtory. So fond are mankind of this vulgar prejudice of imputing all their evils to others, that even inſects muſt, like plague, be imported.

This inſect is, doubtleſs, a new ſpecies of animal; it is one of thoſe varieties which nature is continually exhibiting in the immenſity of her ope-

operations; it is a diftemper incident to that particular plant, and others perhaps in a lefs degree, which, like the Sudor Anglicus, may endure for half a century, and then difappear; or it may be derived from permanent caufes deftined for a longer time to annoy that fpecies of vegetable life, like the mildew on the fame plant on the maritime borders of Maffachufetts and New Hampfhire. The mammoth of Siberia and America, whofe enormous bones are feen in our mufeums, and whofe race is fuppofed to be extinct, may be another inftance of perpetual revolution in the works of nature.

The lofty pine, the glory of the foreft, covers immenfe tracts of our native wildernefs; but when cut down, is not propagated from the roots or ftump like moft other trees. Yet I am told, that in Carolina, whenever the lands are cleared of the native woods, the young growth confifts moftly of pines, though far from any of that fpecies of tree. Similar changes in the fpecies of trees are obferved, on the clearing of lands in other parts of America.

So alfo, on cleaning our lands in every part of America, the foil is foon covered with a full crop of white clover of fpontaneous origin.

Thefe productions are ufually afcribed to the feeds of the plant fcattered by birds, which lie inert while covered with fhade and leaves, and germinate on the accefs of the folar rays. This folution is conjectural; it is, like the importation of

of the fomes of epidemic diſeaſes, founded on mere ſuppoſition; it is the reſort of careleſs ſuperficial obſervers, who will not take the pains to extend their views over the works of nature. Do birds convey the *ſeeds of pine*, and of clover, and ſpread them over hundreds of miles of the wilderneſs? Have theſe ſeeds been all ſcattered within a few years? Or will the ſeeds endure the froſt, the rain, and the heat of ages without periſhing or germinating? Beſides, birds feed on the ſeeds of other graſſes and plants, as well as thoſe of white clover. Why are theſe not ſpread over our woods in the ſame manner?

The phenomena of the foreſts in America preclude the probability, or rather the poſſibility of ſuch events. The new plants that ſpring up are generated by new powers in the elements, occaſioned by different combinations of heat, moiſture and air, introduced by the labours of man; combinations which could not exiſt while the ground was clothed with trees of other ſpecies.

Plants are furniſhed with ſeeds for the purpoſe of propagation. This wiſe proviſion of a beneficent Providence is highly uſeful to man, and to animals which ſubſiſt on the ſeeds. But ſeeds are not neceſſary to the production of plants in all climates. Every vegetable has ſome ſpot on the globe where it is indigenous, where it was originally produced without ſeed, and where it will beſt thrive, and grow to the higheſt ſtate of perfection.

fection. Such was the origin of moſt of the plants now known to man. The principles of animal and vegetable life were contemporary with the formation of the earth. New ſpecies are generated only by thoſe gradual alterations viſible in the operations of nature, or by accidental changes, induced by extrinſic and artificial cauſes.

Animals are alſo produced very often without any parent but the elements. Hear what is recorded by that accurate obſerver Dr. Lind, on the diſeaſes of hot climates, p. 208. "It is a phenomenon inconteſtibly true, that in ſtagnating pools of water at Bombay, produced ſolely by the rains, and which have no communication with any river or the ſea, living fiſh are generated; many perſons have eaten of them. Upon the drying up of the pools they die, and are frequently very offenſive."

I have not the leaſt doubt of this fact: and it is on this principle only that we can account for the exiſtence of fiſh of various kinds, and eels, in brooks and ponds on the tops of hills, above impaſſible falls, and in lakes which have no outlet. And we prove the generation of ſuch animals in the places where they exiſt, not only by the impracticability of their finding a paſſage to ſuch ſituations, but by the fact that many ſpecies of them are never found in ſalt-water, and probably could not exiſt in it. Any perſon may be convinced of the utter impoſſibility of fiſhes making

their way to the heads of many ſmall ſtreams, where they are found, by examining innumerable ſuch ſtreams on our mountains, which are full of trout and other ſmall fiſh, above perpendicular falls among ſolid rocks, of 50 or 100 feet in height.

The truth is, the elements of air and water are fitted to produce animals of the kinds proper to ſubſiſt in them; and ſo are plants. Not a vegetable in the field is formed without its worm, its fly, or other inſect, which it generates or feeds; and the animal, when peculiar to a plant, has the colour and the properties of that plant. Not a ſpecies of vegetable or animal matter, expoſed to a ſuitable degree of heat and moiſture, which does not produce its inſect. Even living animals are not an exception. Are not the large worms formed in the human ſtomach poſſeſſed of animal life? And are they produced by a germ depoſited by an animal of the ſame kind? Not at all; the ſuppoſition is ridiculous. They are a diſeaſe, cauſed by the operation of heat and moiſture on ſubſtances in debilitated ſtomachs, which fail to perform the uſual digeſtive functions*. All animals and plants have their diſeaſes, and the mildew on wheat, and the ſear on

* This is the common theory: ſome perſons ſuppoſe them not a diſeaſe, but part of the animal economy neceſſary to full health. This, however, makes no difference as to the manner of their production.

 vines

vines, are probably the effect of *debility*—that is, of the defective energies of the elements, and consequent defective process in the vegetable functions; or of insects which are the produce of the irregular operations of the elements.

In the year 1788 a horse was publicly exhibited in Philadelphia, with a living animal, of the worm species, in his eye.

See Museum, vol. iii. 500.

A worm of three inches in circumference and twenty inches in length, was found in the liver of Mrs. Holt, of Philadelphia.

Ibid.

When these facts are known and acknowledged, will men still be found to deny the doctrine of equivocal generation*?

All creation is full of these varieties. Even the stellary regions exhibit new stars, either stationary or revolving, which are visible for a longer or shorter time, and then recede from human view. Other luminous appearances, resembling a lamp, a spear, a beam, are often observed, for which we can assign no cause. The new stars may be revolving bodies, which appear to us only in a particular part of their orbits;

* It is not an unusual thing for worms to be generated in the small ulcerations produced by pestilence on the surface of the body. Such is the power of excitement. Several instances have been mentioned in this work.

but

but other ſingular celeſtial appearances are doubtleſs mere variations in the forms of the element of fire.

The fiſh in the ocean are ſubject to the ſame revolutionary laws. They often abandon the banks where they have appeared for centuries, and appear in places where they were never before known. They are ſubject to epidemic maladies as much as man or cattle; they often ſicken and die; and ſometimes it appears, that the whole ſpecies frequenting a particular bank is ſuddenly extinguiſhed.

The changes in the diſeaſes of men; all the phenomena of epidemics, in their origin and diſappearance, their increaſed violence and novelty of ſymptoms, are the effects of ſimilar alterations in the elements which compoſe the ſyſtem. We are but one ſpecies of animals, whoſe bodies are compoſed of the ſame materials, and ſubject to the ſame laws as the bodies of all other animals. Animal and vegetable ſubſtances are alſo compoſed of the ſame elements, variouſly combined; they are ſimply varieties in the forms of matter endowed with life. And the intellectual endowments of man, with all his boaſted pre-eminence, cannot exempt him from the operation of the general laws which govern every other form or combination of the elements.

NOTE, ON THE VENEREAL DISEASE.

I am really ſurprized to obſerve, with what pertinacious obſtinacy men perſiſt, in face of the moſt inconteſtible evidence, upon fathering great evils and calamities on others. The deſcription of Adam's caſting the blame of his ſin on Eve, and Eve's charging the whole to Satan, had it been intended to illuſtrate the practice of tracing diſeaſes to a foreign country, could not have been a more exact repreſentation of the fact, and of the diſpoſition of men to ſhift off, not only crimes, but even moral and political evils, and caſt them on their neighbours. Every nation and every man conjures up a devil, to which all that is *evil* and *diſhonourable* is to be imputed. Pope has well deſcribed this diſpoſition.

> " No creature owns it in the firſt degree,
> " But thinks his neighbour farther gone than he;
> " Even thoſe who dwell beneath its very zone,
> " Or never feel the rage or *never own.*"

The people in the north of Europe maintain moſt ſtrenuouſly that the plague never originates in their countries. Mead even affirms that the meaſles, as well as ſmall-pox, had its origin in Egypt.

The inhabitants of Egypt declare, that the plague does not originate in *their* country, but is always imported from the north, as Conſtantinople, Smyrna, Greece, or Syria; or from the Barbary

bary Coaſt; and this ſilly notion is actually believed and circulated by moſt reputable travellers. The inhabitants of Conſtantinople, I believe, admit that the plague *may* originate in that city; but it is believed by many perſons, that this diſeaſe does not originate there, and they trace it to Egypt. Many Europeans have adopted this opinion.

In Smyrna, Syria, Cyprus, and all parts of Europe, the plague is aſcribed to foreign countries. In Algiers and Fez, and all along the Barbary Coaſt, the plague is held to be imported from Egypt or Conſtantinople. It is immaterial which; the great point being to ſhift off the origin upon neighbours.

Juſt ſo in America; it is not admitted, by a great portion of people that the climate can generate a peſtilence. The yellow fever, which is the plague of the country, is, in popular opinion, always imported from the Weſt Indies. When we go to the Weſt Indies and enquire for the origin of this diſeaſe, we are told very gravely that it does not originate there; it comes from Siam and Bulam; and books are written by able phyſicians to prove the diſeaſe *imported.*

If, then, we are to believe the opinion of the inhabitants of any given country, and their own ſtory to be juſt, we ſhall prove that the plague and yellow fever are generated in no country

 on

on earth*. There is ſomething extremely laughable in theſe facts; but to philoſophy, to medical ſcience, and national candour, they are as diſgraceful as they are prejudicial. My enquiry into the hiſtories of theſe diſeaſes has demonſtrated to my mind, that moſt peſtilential diſeaſes have originated where they exiſted; and no one of them will ſpread or exiſt long in an atmoſphere in which it will not originate.

The ſmall-pox does not uſually ſpread without infection, but I can prove, by many inſtances, that it does originate in ſporadic caſes without infection. In South America it ſpreads and becomes epidemic in certain periods, then totally diſappears.

Ulloa, book vi.

The venereal diſeaſe appears to be propagated ſolely by infection; it muſt, however, have originated at firſt without infection, and *may* ſtill, for ought we know, originate in the ſame manner.

But the attempt of phyſicians to palm this diſeaſe on the natives of America, is a moſt groſs and abominable attack on truth, perſevered in againſt the plaineſt and moſt indubitable evidence.

* "But where the extreme of vice was ne'er agreed;
"Aſk where's the north? at York, 'tis on the Tweed;
"In Scotland, at the Oreades; and there,
"At Greenland, Zembla, or the Lord knows where."
Eſſay on Man, ii. 221.

In the annals of England, there is the cleareſt proof of the exiſtence of that diſeaſe in the twelfth century; and it was the ſubject of legal proviſions as early as the year 1162, which laws are ſtill extant, and were then only a renewal of thoſe which *were ſtill more ancient.* In the records of the Lordſhip of Wincheſter there are many regulations reſpecting the ſtews which were authorized to be kept in Southwark; one of which expreſsly prohibits any "Stew-holder to keep any woman that hath the *perilous infirmity* of (brenning) *burning**."

In a book written from a manuſcript about 1430, in poſſeſſion of the Biſhop of Wincheſter, one article begins thus; "*de his qui cuſtodiunt mulieres habentes nephandum infirmatatem,*" it goes on "*item.* That no ſtew-holder keep noo woman wythin his hous that hath any ſickneſs of *brenning*, but that ſhe be put out, upon the peyne of make it a fyne into the Lord of a hundred ſhillings."

That this was a common diſeaſe, appears from the frequent mention of it in thoſe records; and that it was the ſame diſeaſe now called *venereal*, appears from the deſcription of it given by Arden,

* *Burning* is a modern orthography; the ancient was *brent brenning.* So Chaucer wrote it. Canterbury Tales, 2427, and in other paſſages.

"The fires *brent* upon the auter bright,
"That it gan all the temple for to light."

physician to Richard II. and Henry IV. between 1377 and 1413, who speaks of it as a "certain inward heat and excoriation of the urethra."

This disease was called a *burning*, and went by that name till the middle of the 16th century.

See Philosophical Transactions, No. 357.
Baddam's Memoirs, vol. vi. 390.

It is asserted by European authors, that this disease was prevalent among the natives of America when the Spaniards first visited the country. I cannot controvert the assertion; for I do not possess the original Spanish histories of their first voyages. But it is *possible* this may have been true. It is somewhat strange, however, if that disease was formerly very prevalent among the natives, that, in modern times, it should hardly be known among them.

Ulloa, in his Voyage to South America, book vi. declares, that the "venereal distemper is seldom known among the natives," although so common among the Spaniards as to have lost the infamy attached to it in other countries.

See also book v. ch. 6*.

With

* These remarks on the origin of diseases proceed solely from my love of truth and sound philosophy. I am no more anxious to exonerate the savages of America from the charge of communicating lues venerea to Europeans, than I am to vindicate Egypt from the charge of originating all the plagues that have desolated Europe. It is my wish to

prostrate

With respect to the origin of the lues venerea we are left in the dark, as we are with respect to the small-pox. It is agreed, on all hands, that none of the Greek and Roman writers on medicine have described the disease.

But there is not a shadow of doubt that a species of this disease existed in England as early as the Norman Conquest; and, probably, in the other countries of Europe. Not a medical work of that period, if any was written in the West of Europe, has survived the ravages of time; and we are indebted to the legal establishment of stews in Southwark for the evidence of the existence of that disease.

It is, however, not at all improbable, that about the year 1496 this disease might have acquired some new malignant symptoms, and spread with a fatal rapidity that might alarm mankind, and render the distemper more an object of notice. Antecedent to that period, it might have been

prostrate that system of error, respecting the origin of pestilential diseases, which disgraces modern days.

The following remark is of less consequence. The British dictionaries define the word Buccaneers by "Pirates of America, or American pirates." But names lead to error. The buccaneers were all originally Europeans, French and English, who committed piracies in the West Indies and Spanish America. Encyclopedia, article Buccaneers. — Thus the name "Hessian fly," given in this country to a mischievous insect, is the offspring of ignorance and the parent of a material error in common opinion.

much

much more mild and leſs deſtructive. This idea is greatly ſtrengthened by the known fact that other diſeaſes had, about the ſame time, undergone ſimilar changes. It was but about ten years before that the plague took the *ſweating* form—an event as novel as the generation of a new diſeaſe. What is more remarkable, in the very year aſſigned for the appearance of the lues venerea, an epidemic leproſy overran Germany—an event equally novel. Theſe facts confirm my ideas of certain revolutions in the ſymptoms of diſeaſes, correſponding with material changes in climate or modes of life.

CONCLUSION.

CONCLUSION.

Addreſſed to the learned Societies in America, Europe, and Aſia.

THE preceding hiſtory of epidemic diſeaſes was undertaken ſolely from a deſire of inveſtigating the truth, reſpecting the origin and phenomena of thoſe terrible ſcourges of the human race. When the peſtilence appeared in the United States in 1791 and 1793, I had not a ſuſpicion that the popular doctrines reſpecting contagion are not well founded. The frequent recurrence of the diſeaſe in ſubſequent years, in oppoſition to all the beſt efforts of health officers, in executing rigid laws of quarantine, had, in 1795, ſhaken my confidence in thoſe doctrines. My inveſtigations in that and the next year, convinced me that the peſtilential fever which has viſited ſo many parts of America is generated in the country; but ſtill I had not the leaſt ſuſpicion of a connection between epidemic diſeaſes. The inveſtigations of the year paſt, have reſulted in unfolding principles and facts to me altogether *new* and *ſurprizing*; they cannot therefore be aſcribed to a wiſh to eſtabliſh a preconceived theory.

These

Theſe reſults not only confirm my ſuſpicions that the peſtilence of America is of domeſtic origin, but they overthrow the preconceived ſyſtem of the origin of peſtilence in temperate latitudes, from fomes conveyed to theſe climates from ſouthern regions; and demonſtrate that it originates occaſionally in all latitudes, from the 25th to the 65th. It is demonſtrated that peſtilence, in temperate latitudes, is never an iſolated epidemic, but the criſis of a ſeries of epidemics; and we are furniſhed with the means of determining unequivocally the character of peſtilence, in every caſe, on the following ſimple principles.

If, on the appearance of peſtilence, in a particular place, all other diſeaſes ceaſe, or take ſome of its predominant ſymptoms, that peſtilence is generated in that place, and dependent on the ſtate of the elements.

It is impoſſible, on phyſical laws, that this criterion ſhould ever fail.

Another criterion, almoſt infallible, is the prevalence of certain diſeaſes before and after the peſtilence. If peſtilence is immediately preceded by meaſles, affections of the throat, inflammatory or typhus fevers, with anomalous ſymptoms, and eſpecially by catarrh, that peſtilence is an epidemic produced on the ſpot, and only the *autumnal* form of diſeaſe—the other diſeaſes preceding and following being the *vernal* and *hybernal*

bernal forms, produced by the ſame general principle.

Of the peſtilences which afflict mankind, in all climates, an immenſe proportion, probably nineteen twentieths, belong to this ſpecies: They are epidemics beginning and ending at the command of the elements, under the co-operating influence of ſeaſons and local cauſes.

Theſe epidemic peſtilences are more or leſs infectious according to their violence, or the places where they exiſt. In cloſe rooms and narrow alleys they are dangerous; hence their mortality in fleets, camps, jails, and particular parts of cities. But the infection of ſuch diſeaſes extends to the diſtance of a few feet only, and is capable of diſſipation in a free air, ſo as to reduce the danger of attending the ſick almoſt to nothing. The ſame is true of diſeaſes of mere infection, not epidemic.

Diſeaſes dependent on infection only, are ſometimes brought into cities and hoſpitals, and occaſion conſiderable mortality. But they are propagated by contact or near approach only, and do not affect the character of other diſeaſes current in the place.

The conſequence reſulting from theſe principles is, that *epidemic* peſtilence is not under human controul—but diſeaſes propagated by mere infection may be arreſted and ſubdued.

The

The only means of avoiding or mitigating epidemic peſtilence are, firſt, to withdraw the aid of local cauſes; ſecondly, to fit the body, by modes of living, to reſiſt the cauſes; and, thirdly, on failure of theſe, to remove from the place where it exiſts.

The infection of all diſeaſes, even thoſe of ſpecific contagion, as ſmall-pox and meaſles, may be avoided by keeping at a diſtance from the diſeaſed. The infection of diſeaſes not ſpecifically contagious, as plague, yellow fever, dyſentery, and jail fever, may be nearly deſtroyed by free air and cleanlineſs.

With reſpect to the primary cauſes of epidemic diſeaſes we are in the dark; but we are certain, from all hiſtory and modern obſervations, that thoſe cauſes affect every ſpecies of animal and vegetable life.

The opinions which I have ſuggeſted concerning the general cauſe, ſeem to have a foundation, in the coincidence of epidemic diſtempers, with numerous electrical phenomena. At the ſame time the reader will conſider theſe opinions rather as *conjectural* than *poſitive*. No certain concluſions can be drawn from an interrupted and imperfect ſeries of facts. More materials are neceſſary to enable us to erect a theory of epidemics which ſhall deſerve full confidence.

The common doctrine of contagion is utterly inſufficient and unphiloſophical; for, if admitted, it

it never leads us nearer to the cauſe. If we trace the yellow fever to the Weſt Indies, and the plague to Egypt or Conſtantinople, we are not an inch nearer to the ſource; for theſe diſtempers are not always to be found in thoſe countries, and the people there are as much puzzled to find the ſource of them, as the inhabitants of Great Britain and America.

If we trace theſe diſeaſes to the Coaſt of Africa or to Siam, we are as diſtant as ever from the ſource; for many times they are not to be found in thoſe countries, and ſeldom are they ever found within the tropics, except among foreigners.

Indeed nothing is more common than for the yellow fever to be *imported into the Weſt Indies in veſſels directly from the United States.* When veſſels from northern latitudes have long paſſages, it often happens that ſeamen are ſeized with the diſeaſe before they arrive at the iſlands, and the Weſt Indians might often allege, with truth, that the yellow fever is imported in ſuch veſſels, when it does not exiſt in the United States.

In ſhort, the doctrine of deriving all peſtilential diſeaſes from contagion or infection, were it not for the immenſe miſchief it does to ſociety, would not deſerve a ſerious refutation. *Infection* is a ſubordinate cauſe of the propagation of malignant diſtempers; but is itſelf an *effect* of ſome more general cauſe, whoſe force is a hundred fold more powerful and formidable than that of infection.

For

For the purpofe of collecting facts, the only fafe foundation of principles, and comparing the phenomena of the difeafes and the elements, which occur nearly at the fame time in different countries, I fincerely wifh and requeft that all medical and philofophical focieties, would undertake to regifter facts, and reciprocally to communicate them by means of a general correfpondence. The facts fo regiftered might be comprized under the following heads:

The time of the appearance and difappearance of any epidemic difeafe, with its general hiftory.

The places where it firft occurs to be defcribed in regard to land and water, height of the ground, conftruction of the city or ftreets—pofition as to points of compafs, woods, moraffes, &c. The claffes of people moft generally affected—the general ftate of feafons as to heat and cold, drought and moifture.

The time of earthquakes, meteors, lumen boreale, and all fingular celeftial appearances—unufual ftorms, efpecially when accompanied with hail—all compared with the lunar phenomena.

The appearance of unufual infects of all kinds, and any circumftance attending them.

Difeafes among cattle, fheep, and other animals—ficknefs and death of fifh of any kind.

Volcanic eruptions, with the phenomena preceding, attending, and following them.

For

For the purpose of ascertaining the lunar influence on the human body, or any diurnal influence, it would be desirable that medical gentlemen should note the days, and the hours of the day, when persons are seized with particular diseases, especially epidemics; the hours most fatal to the sick—the hours of exacerbation and paroxysms in fever, and the time when convalescents are most apt to relapse.—These facts should be compared with the position of the moon in her orbit, and especially in regard to her perigee and apogee; conjunction and opposition; as also with the tides in the main ocean *.

Should the principles unfolded in the preceding work prove to be well founded, they will lead to many important practical inferences.

I. If pestilential fevers never appear in the temperate latitudes without certain precursors, men will, with careful observations, be enabled to foresee the danger and prepare for it, or to use uncommon diligence in the removal of subordinate local causes.

II. If, in certain years, pestilential fevers are more predominant than in others, and the condition of the elements fitted to produce them is universal over sea and land, the fact is of no small moment in maritime affairs. Double precautions

* The time of high and low water in rivers and bays, may not be the true time in the open sea—or of the greatest and least influence of the moon.

will be taken in fleets and in merchantmen bound on long voyages.

III. If peſtilence is progreſſive, and firſt manifeſted in certain malignant precurſors, the fact may be of great utility to large cities. The approach may be perceived in time to ſave the inhabitants by flight, if not by other precautions.

IV. If no plague or yellow fever ever appeared in temperate climates, unleſs announced by other diſtempers, the magiſtracy may be enabled to diſtinguiſh when there is danger and when not; and may avoid innumerable vexations to commerce, occaſioned by the rigid execution of health laws, when there is not the leaſt danger.

V. But a moſt important uſe to be made of the facts here collected, will be to guard public health from the ill effects of bad proviſions. If, in peſtilential periods, ſalt is leſs efficacious in preſerving fleſh, and by means of a greater fermentation of the juices, fiſh and fleſh are more readily diſſolved by a putrefactive proceſs, more caution will be found neceſſary in packing and re-packing them, and more care to avoid uſing them in a bad ſtate.

If the effluvia of diſſolving fleſh and vegetables are more poiſonous and prejudicial to health at ſome times than at others, it is of importance that, on every ſuch occaſion, early notice ſhould be given of the danger.

If

If animals, which conftitute a part of the food of men, are fubject to epidemic diftempers, they cannot be eaten with fafety while affected by difeafe. When fifh or fowls are fickly, and many of them die, or become lean, the fact fhould be afcertained by the faculty, or a board of health, and public notice fhould be given, that people might avoid ufing them as food. In fome inftances fifh are fo fickly as to excite naufea, in which cafe the ufe of them fhould be forbidden.

I will clofe this treatife with the following reflections.

In the conftruction of the univerfe we obferve every part of the fyftem to be governed by uniform laws, adapted with infinite fkill to preferve harmony and order. Limited as our underftandings are, we can difcover many of thefe laws, which are calculated to imprefs on our minds the moft fublime ideas of the univerfal intelligence and wifdom of their great AUTHOR.

The exiftence of natural and moral evils has led fceptics to queftion the perfections of the Author of nature. But doubts on this fubject argue want of knowledge or want of candour. It is very evident that all the neceffary evils of the fyftem are calculated to produce good.

The operations of that univerfal principle of light, heat and fire, which pervades our fyftem, and

and which is inceſſantly compounding and decompounding the other more ſluggiſh materials of the earth and atmoſphere, are eſſential to the viciſſitudes of the ſeaſons, rain, ſnow, hail, and dew, all which are neceſſary to preſerve the principles of animal and vegetable life. Storms, hurricanes, earthquakes, and volcanic eruptions, however inconvenient to man at particular times and places, are among the means of giving to the principles of life more equal diſtribution, and of renewing their energies.

Epidemic diſeaſes are the neceſſary effect of the general laws that govern the univerſe. But they have alſo a final cauſe of immenſe value to the human race. They are deſtined and calculated to anſwer moſt important moral and religious purpoſes.

Men, with their preſent natures, under a conſtant courſe of proſperity, would degenerate into brutes or devils. Uninterrupted eaſe and quiet contract the heart, and ſteel it againſt emotions of ſenſibility—the man ruſhes into crimes, or ſinks into ſloth. So often have I ſeen the hearts of men depraved, and their moral character debaſed by ſudden proſperity, that I am perſuaded the world, without frequent inflictions of pain and diſtreſs, would not be habitable.

The natural evils that ſurround us, intermingled with innumerable bleſſings, preſerve the mind in perpetual vigour, in ſeeking the means of protection;

tion; they lay the foundation for the exercise of the finest feelings of the human heart, *compassion* and *benevolence*, which are the principal sources of social virtue; they humble the pride and arrogance of man, by creating in his mind a perpetual dependence on divine power; in short, they create and keep alive that sense of obligation and accountability to God which is the germ of piety, and the basis of moral excellence.

ADDENDA.

Of the Lunar Influence.

IT is a well known fact, that the moon has a great influence on the elements of this globe, the effects of which are very visible in the vicissitudes of weather. This influence is supposed to be the principal regulator of the tides, and the efficient cause of the changes in the atmosphere, which produce rain, hail, snow, and wind. It is believed also to affect the growth of plants, and Pliny, followed by St. Pierre, alleges that the lunar rays dissolve snow and ice. Popular opinion considers the moon as exerting a powerful influence on animal substances, and it is an incontrovertible fact that its beams accelerate the putrefaction of flesh and fish. Fishermen and sailors can all attest this fact, and it coincides with what Pliny asserts. Nat. Hist. lib. ii. 101. "*Id manifestum esse, quod ferarum occisa corpora in tabem viso suo resolvat* *." Moon light dissolves or corrupts the flesh of animals that are killed; it renders

* St. Pierre affirms that the moon melts ice, and relies on the passage of Pliny in the chapter cited, "*glaciem refundat*"—but it is questionable whether the passage will bear that construction—and if it will, the assertion of Pliny is not

renders found fish soft in a few hours; and fishermen are careful to cover from its rays, the fish they have caught. It probably acts upon flesh by stimulus, exciting a fermentation in the juices.

The Newtonian theory of tides, which explains the phenomena by lunar attraction, has been recently called in question and warmly opposed by the ingenious St. Pierre, in his Studies of Nature, who substitutes a scheme of his own, which ascribes the tides to the diurnal effusions of the polar ices. I am charmed with the writings of St Pierre, which have opened a new and entertaining volume of the works of nature. But his theory of tides seems to manifest none of that ingenuity which is conspicuous in other parts of his writings, and is utterly unsatisfactory.

In the first place, during six months or more in each polar region, no snow or ice is melted, unless by the moon. The sun is below the horizon, and the moon's influence, if it dissolves snow and ice, according to Pliny, evaporates all the water produced. This is a fact that accords with modern experiments, that ice in the night, however cold, loses a part of its weight, but it is by insensible evaporation.

To remove this difficulty, St. Pierre supposes the tides in one polar region to be the effect of the

not supported by modern observations. See Studies of Nature, vol. i. Expl. of the plates, p. 69. Ice is diminished by evaporation in moon light, without forming water.

 melting

melting of ſnow and ice, in the oppoſite polar regions. But to this hypotheſis we may oppoſe an inſuperable objection, derived from the great and univerſal laws of equilibrium obſerved by water. A diurnal wave or elevation would inevitably ſubſide into a level, before it could reach the equator, or even the temperate latitudes. Beſides, the Atlantic is of very various breadth, in different latitudes. Between the coaſt of Brazil and Terra Firma on one ſide and Africa on the other, the breadth is ſcarcely half as great, as in the latitude of 25° North. A diurnal wave, compreſſed and dilated in thoſe different ſituations, muſt exhibit the tides in one place twice as high as in another; but in the regions mentioned this is not the fact.

In America we have, every ſpring, the cleareſt evidence that the tendency of water to an equilibrium, utterly overthrows St. Pierre's hypotheſis. In the months of March and April the ſnow and ice in New-England are diſſolved, and the water is poured into the large rivers: when this operation is performed by the heat of the ſun, which is moſt generally the caſe, the water made by melted ſnow is diurnally poured into the ſmall ſtreams, which communicate with the large rivers.—During the night this operation ceaſes, and inſtead of thawing, the cold is uſually ſufficient to freeze water. Theſe diurnal effuſions are often immenſely great, and wholly ſuſpended during the night; yet within

within forty-eight hours, and in the courſe of 200 miles currency, in a large river, the water acquires a level, and no diurnal riſe or fall is obſervable. This fact in Connecticut river, the Nile of America, has been under my obſervation for a number of years.

There are many of the phenomena of the tides which cannot be explained on St. Pierre's hypotheſis; but the foregoing remarks are ſufficient for my preſent purpoſe. The tides, doubtleſs, depend on lunar and ſolar influence; but the phenomena cannot be ſolved on the common theory of *attraction*. In this reſpect, I am confident the Newtonian theory, as explained by Kepler and others, is as inadequate, as that of St. Pierre. The latter author has enumerated ſome inſuperable objections to that theory, to which the reader is referred. But I have other obſervations to make on this ſubject, which are probably new.

The manner in which aſtronomers have attempted to explain the oppoſite tides, is as follows:—" The power of gravity diminiſhes as the ſquare of the diſtance increaſes—therefore the waters on the ſide of the earth next to the moon are more attracted than the central parts of the earth; and the central parts are more attracted by the moon than the waters on the oppoſite ſide of the earth—therefore the diſtance between the earth's centre and the waters on its ſurface, under

and opposite to the moon, will be increased.— The earth by its gravity falls towards the moon— the water directly below the moon rises and swells towards her; the water on the opposite side recedes from the centre and rises; or, strictly speaking, the centre recedes from the water. On the sides of the earth between the points under and opposite to the moon, the water is depressed and falls below the former level."

See Ferguson's Astronomy on the Tides, and Encyclopedia, Art. Astronomy, 363.

As I am not about engaging in astronomical or mathematical calculations, I shall content myself with stating these general principles of Newton, Kepler, and later astronomers, with a few objections.

I. This theory does not explain, in a satisfactory manner, the reason why there are no tides in lakes and Mediterranean seas.

If the principle is just, that the earth recedes from the water opposite to the moon, leaving the surface of it at a greater distance from the centre, why, when the Euxine or Mediterranean is opposite to the moon, does not the earth between these seas, recede from *their* waters, as well as from the waters of the ocean in the same longitude? The earth consists of solid substances, and, by the laws of attraction, must, in all its parts, be moved equally, under the same circumstances

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of diſtance from the attracting body and denſity, or ſolid contents. To ſuppoſe the earth, when covered by an ocean, to be attracted by the moon, and not when covered by a lake or arm of the ocean, is, in my view, neither logic nor philoſophy.

Nor is the reaſon aſſigned for the defect of tides in lakes and ſeas, on the ſide next to the moon, in the leaſt ſatisfactory. It is found in the Encyclopedia in theſe words: "There are no tides in lakes, becauſe they are generally ſo ſmall that when the moon is vertical, ſhe attracts every part of them alike, and therefore by rendering all the water equally light, no part of it can be raiſed higher than another."

But this explanation does not meet the difficulty. The Newtonian theory ſtands on the hypotheſis that the waters on the ſide of the earth next to the moon are more ſtrongly attracted than the adjacent land; therefore they riſe above ſeveral feet of the earth. But the ſolution above recited does not reach this point; for the waters of the ocean riſe *higher* than the contiguous earth; but the waters of lakes always obſerve the ſame relative altitude on their ſhores. If then the moon attracts the waters of lakes at all, or occaſions them to riſe, it attracts the adjoining earth, and raiſes it the ſame degree as the waters; but in regard to the ocean, it attracts the water, and leaves the contiguous earth behind. In ſhort,

ſhort, if attraction and gravity have uniform laws, as we muſt believe they have, the attraction of the moon will *not* account for tides in the ocean, while there are none in lakes and inland ſeas.

II. If the moon's attraction is the cauſe of tides, why is its force much leſs in the equatorial regions, than in the diſtant parts of the globe? It is a well known fact that the tides within the tropics are very ſmall, and that they are more conſiderable as we recede from the equator towards the poles. This is contrary to what ought to be the caſe, on the principles of attraction; for, on the Newtonian theory of gravity, the higheſt tides ſhould be on the parts of the earth neareſt to the moon. The reverſe of this is the caſe, and the circumpolar regions of the earth have the higheſt tides.—The tides within the tropics are from 12 to 24 inches—in the latitude of Greenland, almoſt as many feet.

III. The theory of Newton is not reconcileable with his own principles of gravity, which ſuppoſe the force of it to be equal to the quantity of matter contained in bodies. Now the theory implies, that on the ſide of the earth next to the moon, the water is attracted *more* than the earth; but on the oppoſite ſide, *leſs*. This cannot be ſolved on the principle of *diſtance*; for this is too ſmall to account for a hundredth part of the effect. Indeed the water and the land on the ſhore, may be conſidered as at the ſame diſtance.

Nor

Nor can it be ſolved on the principle of a difference in the quantity of matter in earth and water. If the earth, having more denſity and matter, is moſt attracted, the principle muſt act uniformly on both ſides of the earth; on both ſides the earth muſt move towards the moon further than the water; which is contrary to fact.

If the water has moſt matter, the ſame principle muſt govern it on both ſides of the earth, and move it fartheſt towards the moon.

But here the principles of coheſion interfere with all theſe deductions. Theſe principles are ſo powerful as to overcome the attraction of a diſtant body, nor is it to be ſuppoſed that the power of the moon overcomes the force of coheſion, and, by attracting the parts of the earth next to it more than the parts on the oppoſite ſide, changes the form of the earth from a ſphere to a ſpheriod. It is not ſuppoſed that the whole ſolid maſs of the earth is continually changing its figure by means of lunar attraction. If ſo, this figure muſt be rotatory.

The theory, then, ſuppoſes that on the ſide next to the moon, the water is moſt ſtrongly attracted, and riſes above the earth; but on the ſide oppoſite, it is attracted leſs than the earth. The ſolid globe is moved towards the moon, and the water left lagging behind! What is more ſingular, the earth near the equator on the ſide oppoſite,

oppoſite, is drawn only two feet further towards the moon than the water, or perhaps but one foot; while, in the temperate latitudes, it is drawn ſix or eight feet, and, in the latitudes of 60 and 70 degrees, fifteen, eighteen, and twenty-five feet further than the water. This may be philoſophy; but to me it is utterly unintelligible!

Nothing is a more ſerious misfortune to ſcience than the errors of a Great Man. Moſt of mankind take principles and facts upon truſt, and defend them with a zeal proportioned to their confidence in the man who has publiſhed them. I revere the character of Newton, of Kepler, and of Haller; but this veneration does not in the leaſt incline me to receive their doctrines without being convinced that they are well founded. After moſt careful inveſtigation, I am ſatisfied that the principles of attraction will not account for the tides oppoſite to the moon, nor for the difference between the height of the tides in different latitudes; yet I have not the leaſt doubt that moſt of the phenomena of tides are regulated by the moon.

If I was aſked, on what principles the tides depend, my anſwer would be, *I do not know.* But numerous facts, all concurring to the ſame point, lead me to *ſuſpect* the vibrations of the ocean to depend on electricity, influenced by the moon, the ſun, or other diſtant orbs, and acting by repulſion as well as attraction, or by increaſing and diminiſhing the elaſticity of the water.

In

In the firſt place, it is agreed among philoſophers, that the air, when free from vapour, is an electric; that when cold, it is moſt electric; and when heated, it becomes a conductor; and, conſequently, that the atmoſphere in the torrid zone is always in a conducting ſtate, while the air of the northern regions, if clear, is an electric. In ſhort, it is agreed that the atmoſphere of the temperate and frigid zones contains more electricity than that of the torrid zone.

Theſe facts correſpond with the phenomena of tides. In the regions where there is the leaſt electricity, there is the leaſt intumeſcence of the ocean: thoſe are the equatorial regions. There the temperature of the air alſo ſuſtains very ſmall variations; ſo does the height of the ocean. As we recede from the equator, cold and electricity increaſe; ſo does the elevation of the tides.

Again, the ſame train of phenomena attends the barometer. Within the tropics, the variations of the mercury in this inſtrument are very ſmall; but in the temperate and cold regions they are more conſiderable, and increaſe as we recede from a warm to a cold, electric atmoſphere.

Similar phenomena attend the twilight. Within the tropics the twilight is of much leſs duration than in cold regions. " Heat," ſay philoſophers, " diminiſhes the air's refractive power and denſity, and cold increaſes both. The horizontal refractions

tions are near one third leſs at the equator than at Paris.

Ferguſon's Aſtron. 97.

The denſity of the atmoſphere within the tropics may be leſs than at the polar circle; but the weight is nearly the ſame, the barometer being in general as high at the equator as in northern latitudes. But the air in hot climates has leſs powers of refraction; that is, there is more power of refraction in an atmoſphere that is moſt perfectly electric, or that contains moſt electricity.

It is remarkable alſo that, in equatorial climates, the atmoſphere exhibits no viſible ſtreams of electricity, as it does in the polar circles.

I know not how far this parallel may be extended; but there is a ſurpriſing reſemblance between all theſe phenomena. In general, then, we obſerve that, in the equatorial regions, the denſity, weight, elaſticity, and temperature of the atmoſphere, are more nearly uniform than in northern climates; and the elevation of the ocean in tides correſponds with this uniformity. As we recede from the equator, the variations of the atmoſphere increaſe, and ſo do the variations in the height and depreſſion of the water.

From theſe phenomena a ſuſpicion ariſes, that the medium by which the moon and ſun act upon

upon the ocean is the electrical fluid, as their influence appears to be in proportion to the electricity of the atmosphere. Hence the highest tides at a distance from the equator, where the heat and cold, and elasticity of the air, are subject to great variations.

By what law, it will be asked, is this effect produced? I readily confess my ignorance. But the phenomena of opposite tides seem to bear a great affinity to the well-known laws of electricity, *attraction* and *repulsion*, and a positive and negative state. I pretend not to account for the phenomena; for I am persuaded that the experiments on electricity which man is capable of making, will never unfold *all* its properties, nor explain *all* the laws by which this energy of nature is exerted in the government of the material system.

But the influence of the planets on the elements of this globe has, in all ages, been a subject of belief or of derision; and surely it is a subject in physics much more interesting to man than many speculative questions which cannot affect his health and happiness, but which occupy the labours of investigating minds. I will therefore throw together a few observations which may afford light on the subject, or at least may excite a spirit of enquiry.

In the first place, it is generally known and admitted, that the influence of the sun and moon

upon this globe are in proportion to their proximity. The higheſt tides are when the moon is in her perigee and in conjunction with the ſun, and eſpecially when the earth is in her perihelion, or neareſt to the ſun. But the moon exerts more than uſual influence on the atmoſphere in other poſitions. Her power is greateſt in her perigee and apogee, and in her conjunction and oppoſition to the ſun. Her influence on the tides, under the combined and ſeparate operations of theſe circumſtances, has been fully illuſtrated. But her influence on vegetation, on the viciſſitudes of the weather, on health, and the phenomena of the electrical fluid in earthquakes and volcanic eruptions, ſeems to have paſſed unobſerved, or at leaſt to have never been reduced to any thing like ſyſtem.

One of the moſt ſtriking effects of lunar influence is obſervable in earthquakes, which uſually happen near the time of the moon's perigee or apogee, conjunction or oppoſition. As this fact ſeems to have eſcaped obſervation, I will here inſert proof of it.

The great earthquake which demoliſhed Lima on the 28th day of October, 1746, happened ſix hours before the full moon, and the day before her apogee.

That which deſtroyed Liſbon, Nov. 1, 1755, was three days before the change, and four before her perigee.

The great ſhock in America, on the 18th of the ſame month, was a few hours after the full moon, on the day of her apogee.

The great earthquake in America, on the 2d of June, O.S. 1638, was on the day after the new moon, and one day before her perigee. (Some accounts place this on the firſt of the month; in which caſe it was the ſame day with the change.)

The ſhock which convulſed America, and demoliſhed mountains in Canada, January 26th, O. S. 1663, was on the day preceding the new moon.

The great earthquake in S. America, June 3d, O. S. 1744, was four days after the new moon.

The memorable earthquake in North America, on the 29th of October, O. S. 1727, was about three days before the new moon, and on the day of her perigee.

The ſhock in America, on the 29th of November, 1783, was on the day after the moon's perigee.

That on the 16th May, 1791, was on the day of her perigee, and one day before the full moon.

The ſhock on the 1ſt of November, 1761, was the day before her apogee.

The great earthquake in Iceland, on the 10th of July, 1789, was on the day of her apogee, and three days after the full.

 That

That in Tuſcany, on the 30th of September in the ſame year, was two days before her apogee, approaching the full.

A ſhock at Liſbon, on the 27th of November, 1791, was two days after her perigee and change.

A ſhock on the 15th of January, 1791, in Virginia, was two days after her apogee, and approaching the full *.

Theſe two laſt inſtances, according to another almanack, happened *one* day after the perigee and apogee. I have not taken pains to enter into *exact* calculations of the moon's place, as I do not deem it material. It is ſufficient for my purpoſe that *almoſt all* earthquakes happen near the time of the moon's conjunction and oppoſition, or her perigee and apogee. Of theſe poſitions it is obvious that her perigee and apogee have much the moſt influence; and the inſtances I have examined are almoſt equally divided between theſe two poſitions. Of all the earthquakes which I have compared with the moon's place, one or two only fall in her quadratures, and at her mean diſtance from the earth. An inſtance happened on the 11th of April, 1799, in Carolina. I have compared ſeveral other inſtances, which happened near the perigee and apogee; but it is un-

* A ſevere earthquake in the weſt and north of France, on the 25th of January of the preſent year, 1799, was a few hours after the moon's perigee.

neceſſary

necessary to specify them. The examples mentioned will establish the generality of the fact, and the soundness of the principle.

On the principles of *attraction*, it will readily be admitted that the proximity of the moon to the earth, at certain periods of her revolution, must *draw*, or excite into action and discharge, the electricity of the earth. This accounts for earthquakes during the moon's perigee. But on enquiry, we find a great proportion of the shocks take place during her apogee, where her distance is greatest and her power the least; and not only so, but during her opposition to the sun, when her *diminished* influence is supposed to be counteracted and still *further diminished* by the attraction of the sun. This is an important fact, and deserves investigation. That the influence of the moon is the direct exciting cause of earthquakes, can hardly be questioned, after establishing the fact that four out of five, or a much larger proportion, happen when she is in particular parts of her orbit; but why her greatest distance, and her least, should produce exactly the same effects, a fact equally well established, is a question which can perhaps be solved only on electrical principles.

That the electricity of the atmosphere and earth is the medium by which the moon acts upon the elements of the globe, is rendered probable by another fact. I possess the exact dates

of very few volcanic eruptions, but by comparing ſuch as I have with the moon's place in her orbit, I find theſe eruptions begin, or ſuffer violent exacerbations, at the time the moon is in her perigee or apogee, or in her conjunction or oppoſition.

The great eruption of Veſuvius in 1779 was augmented on the 8th and 9th of Auguſt, when the moon was in her perigee.

The great eruption of Veſuvius, and the earthquake which buried Herculaneum, A. D. 79, on the 1ſt of November, were the ſecond day after her perigee.

The tremendous eruption of Heckla, in 1783, began on the 1ſt of June, when the moon was in her apogee, and increaſed till the 8th, after which it continued to be violent for a long time.

An eruption of Veſuvius on the 10th of May, 1784, was during the moon's perigee.

An eruption of fire near Palermo in Sicily, on the 13th of March, 1785, was two days after her perigee.

An eruption of Etna, on the 19th of May, 1780, the dark day in America, was the day after the full moon.

A dark day on the 9th of Auguſt, 1732, was about the time of the new moon, and her apogee. The dark day at Detroit, October 16th, 1762, was the day after her perigee, and one day before the change.

The

The eruption of Veſuvius, March 8th, 1730, was on the day after the new moon, and a great exacerbation happened on the 14th, the day before her apogee.

The great eruption of the ſame volcano in 1794, was announced on the night of the 12th of June, nine hours before the full moon, by a violent earthquake. The eruption took place on the 15th.

The darkneſs in Canada, on the 15th and 16th of October, 1785, was on the days next preceding the full moon and her perigee. The obſcurity on the 9th of that month was near the quadrature.

The eruption of Heckla in 1766, began on the 15th of April, the day before the moon's apogee.

The influence of the moon in producing ſtorms of rain, ſnow and wind, is univerſally admitted, and that theſe happen near the poſitions of the moon, already deſcribed, no man will undertake to deny. The Weſt Indians expect hurricanes only near the time of the full and new moon; or her perigee and apogee.—This is further evidence, that the electrical fluid is the inſtrument of theſe commotions in the atmoſphere. Electricity is known to be the cauſe of winds, and its agency is viſible in producing hurricanes, for experienced ſeamen foretel a hurricane by the unuſual tranſparency of the water. Now, it is a well-known

fact, that electricity possesses the singular property of giving transparency to opaque bodies.

A little before a hurricane in the West Indies, seamen can see the lead at an unsual depth: the sea also swells and rolls upon the shore in a singular manner, though the air is perfectly tranquil.—An effervescence, also, or bubbling, is observed in the water;—dark clouds are formed, and the atmosphere, before the tempest, is obscured by vapours sensibly mephitic.—See a letter from Governor Ellis, dated March 6th, 1789, in the 9th vol. of Museum, 215.—Hence we observe the correctness of the common saying among seamen, that "hurricanes come out of the sea."—They are evidently generated by extraordinary discharges of electricity.—Hence they are most frequent in the Windward Islands, which are all volcanic; some of them still discharging fire and smoke at times, and all of them evidently resting on a volcanic base.

Further, that electricity is the great agent in these agitations of the elements is rendered probable by the coincidences in time, between the more violent hurricanes and great volcanic discharges from Etna, Vesuvius and Iceland.—Witness the terrible hurricanes of 1747, 1766, 1772, 1780, 1784 and 5, all of which happened near the time of great eruptions from the volcanoes mentioned, all of which are distinguished in the annals of the Antilles, and still recollected with horror by the

the inhabitants. And this circumſtance is no inconſiderable evidence, that the agent in volcanic eruptions, as well as in hurricanes, is electricity, and that this element is often diſturbed or ejected from the whole globe nearly at the ſame time.

Moſt of the great tempeſts in all latitudes happen near the moon's perigee and apogee; and in theſe poſitions we obſerve eſſential changes in the temperature of the atmoſphere. I have taken ſome pains to compare the changes in heat and cold with theſe poſitions of the moon, with a view to learn whether the effects are uniform.—On examining the ſtate of the thermometer for two years, I find that in almoſt every inſtance of the moon's perigee and apogee, eſpecially in winter, there was a conſiderable change of temperature.—Uſually the weather grew colder as the moon approached her perigee; but the effects were not uniform; ſometimes the weather became more temperate at the perigee:—But one general remark will be found true, that in regard to heat and cold, the moon's apogee and perigee produce at different times preciſely the ſame effects.—This remark accords with what has before been obſerved in regard to earthquakes.

It is a general remark that the weather becomes cooler as the moon approaches the change. Should this remark prove to be well founded, the reſult would be this principle, that the cold is increaſed, or rather, the heat leſſened by the combined in-

fluence of the ſun and moon. This principle would accord with another obſervation juſt made, that the weather is cooler, during the moon's perigee, which is generally true in winter; that is, the greater power is exerted by diſtant orbs on our atmoſphere the more the heat is diminiſhed; but this obſervation is not univerſally true.—It is true that our winter occurs during the earth's perihelion, but this is uſually explained on the principle of the obliquity of the ſun's rays, a ſolution that, perhaps, is not completely ſatisfactory.

It is a popular opinion that vegetation is leſs rapid, and the fleſh of animals leſs firm and ſubſtantial, and new ſhooting plants leſs vigorous during the wane of the moon, than during her increment; this opinion is too general and too reſpectable to be conſidered the fruit of ignorance and credulity.

Ariſtotle alleges that the cloſe of the lunar month is cooler than the other parts of it, and that during the decreaſe of the moon, the bodies of living animals poſſeſs leſs heat than at other times. *De gener. animal.* lib. 2, 4. Theſe remarks, whether true or not, coincide with the modern popular opinion juſt recited.

We are apt to neglect the opinions and practices of barbarous nations, and to hold in contempt the knowledge of ancient nations: this often happens, I ſuſpect, becauſe we are leſs wiſe than thoſe whom we affect to diſpiſe. Cæſar in his firſt book of the Gallic War, chapter 40,

relates

relates that the ancient Germans, who were great obſervers of the phaſes of the moon, declined engaging in battle during the wane of that planet.—He had offered battle to Arioviſtus, but this commander declined a general action, and permitted only ſkirmiſhes.—Cæſar enquired of his priſoners the reaſon of this conduct, and was told that it was cuſtomary with the Germans to conſult their venerable matrons, who, by means of lots and divination pronounced on the propriety of giving battle; and theſe had declared that it was not poſſible for the Germans to conquer if they engaged in action before the new moon. "*Non eſſe fas Germanos ſuperare, ſi ante novam lunam prælio contendiſſent.*"

See Cæſar's Commentaries in the paſſage cited, and Henry's Hiſtory of Britain, vol. i. chap. 4.

We have this cuſtom of the Germans preſented us, diſguiſed with ſuperſtition, but I ſtrongly ſuſpect it had its origin in the obſervation of the fact mentioned by Ariſtotle, that in the decreaſe of the moon animal bodies have leſs heat and vigour.

I am more inclined to believe this, becauſe the doctrine accords with modern obſervations concerning the invaſion of fevers, and eſpecially of epidemic diſeaſes. Many medical authors concur in the fact, that diſeaſes more generally attack the human body on the ſecond or third day before

before the new or full of the moon. On examining the accounts of several writers, I find the times of invasion to be two or three days before or after the full and new moon, or about the time of its conjunction with the sun.

See Jackson, Grainger, Lind, and many others.

Diemerbroeck is explicit on this point.—He relates, that in the plague of 1636, "two or three days before and after the new and full moon, the disease was more violent; more persons were seized at those times than at others; and those who were then seized, almost all died in a very short time.—Many patients who appeared before to be slightly affected, *nescio qua virium labefactione oppressi*, says the author, by an unaccountable decline of strength, sunk and died in a few hours."

De peste, p. 9.

From the observations of physicians, it then appears that this debility of the animal powers takes place near the time of the conjunction and opposition of the sun and moon, near the moon's perigee and apogee, and in the same positions in which earthquakes and storms more generally occur.

Of the reality of this effect of the elements on the body, there can be no rational doubts. About the time of the change of the atmosphere, which indicates an approaching rain or storm, persons of debilitated

debilitated habits of body perceive the change by a loſs of vivacity, dulneſs, or heavineſs; parts of the body that have loſt their natural energy by means of wounds and tumours, experience painful or uneaſy ſenſations, by which ſtorms are often predicted.

Fowls perceive this change in the atmoſphere, and manifeſt their ſenſations.—Candles ſparkle and ſnap; the tallow melts more freely, and the flame is leſs ſteady. Theſe things were obſerved by Ariſtotle and Pliny.

This change in the atmoſphere is not only perceptible by the ſenſe of feeling, but becomes viſible. Diſtant objects ſeen over water, and ſome writers ſay, over land alſo, *loom*, that is, riſe or appear elevated ſeveral degrees above their uſual attitude. The ear, alſo, will aid us in foretelling rain and wind, for ſounds become audible at an unuſual diſtance.

Perſons in full health are not ſenſible of theſe changes in the elements, at leaſt, they are not ſo much affected as to obſerve them; but from many years obſervation I am convinced that the catarrhal affections which paſs under the popular name of *colds*, are occaſioned by the alterations in the atmoſphere which precede changes of weather, and few of them from the application of cold. I know this to be the caſe with myſelf; thoſe phaſes of the moon which have been mentioned as producing great effects on the earth

and

and atmoſphere, rarely paſs without affecting me with ſlight catarrh. This has been remarkably the caſe ſince the fever of 1798, which left me in a ſtate of debility. But many perſons can atteſt the truth of the principle; nothing being more common than for perſons to remark, that they cannot tell how they took cold, and it being well known that catarrhs are more general and ſevere on the tranſitions from cold to heat, than from heat to cold. The obſtruction of the glands is evidently the effect of an inſenſible change in the atmoſphere, probably, by means of the decompoſition of the electricity and the vapour or other elementary ſubſtances of the atmoſphere. And the winds to which we aſcribe the changes of weather are unqueſtionably an *effect*, rather than a cauſe of thoſe changes.

Theſe alterations in the atmoſphere appear to have ſome connection with the tides, or rather with the cauſe of tides. It is ſaid by ſeamen and other obſervers of the ſeaſons, that full tides are apt to produce rain, that rain which begins at high water will ceaſe with the receſs of the tide; but rain beginning at low water will be of conſiderable duration. Theſe and other obſervations, if juſt, as I am inclined to believe, manifeſt an influence of the tides over the ſtate of the atmoſphere, or a dependance of both on one common cauſe; the ſame inviſible energy of electricity producing both effects.

It

It is a known fact that the flowing tide often brings with it a breeze of wind. This is ascribed to the friction of the water on the air, and the cause assigned may be sufficient to account for the phenomenon. But it may be suggested whether the electricity of the atmosphere may not produce both the tide and the wind. The intumescence of the ocean, previous to earthquakes and hurricanes which are evidently occasioned by electricity, seems to bear a great analogy to the tides, and to authorize my suspicions.

There are many diurnal and periodical phenomena which are evidently connected with the lunar and solar influence, and deserve to be mentioned in this place.

It is a well ascertained fact, that in the tropics where the weight of the atmosphere is subject to very small variations, the barometer uniformly rises and falls with the tides about two thirds of a line.

Encyclop. *Art. Wind.* This is a small variation.

But it is also asserted that in those regions, "the variations in the gravity of the atmosphere seem to depend on the heat of the sun, as the barometer constantly sinks near *half an inch* every day, and rises again to its former station in the night."—Encyclop. *Art. Atmosphere.* I suspect the words "half an inch" to be an error.

Now, if the barometer depends for its fluctuations on heat, we should suppose the same cause would

would operate in northern latitudes and occaſion a diurnal riſe or fall in an exact ratio to heat and cold. In this caſe a barometer would be a thermometer reverſed, riſing with augmented cold, and ſinking with an increaſe of heat. But this is not the fact; the barometer often riſes with the increaſe of heat between ſunriſe and twelve o'clock. Heat, therefore, cannot be the direct cauſe of the diurnal depreſſion of the barometer in the equatorial climates, unleſs it has different laws in different latitudes, which philoſophy will not admit.

Let us compare the facts ſtated with the known phenomenon of the different forces of water during the day and the night. The water-wheel of any mill, the altitude of the water and the reſiſtance being preciſely the ſame, makes more revolutions in a minute, during the night, than in the day time. I have long been acquainted with the fact, and it is known to every miller, but as I have never ſeen a ſtatement of it in any philoſophical work, I have had the curioſity to make an accurate experiment to aſcertain the difference. This was done on the night after the 28th of May 1799, the weather being perfectly ſerene, the air free from vapour, not a breath of wind ſtirring to ruffle the water, and the barometer on the evening preceding, at half paſt eight, ſtanding at $30\frac{1}{10}$.

The firſt obſervation was made at a quarter before

before 7 P. M. ſometime before ſun-ſet, the thermometer ſtanding at 65°, when the wheel of the mill made exactly 16 revolutions in a minute. The altitude of the water was marked with preciſion, but the delivery of the water not having been exactly adjuſted to the current entering the pond, the water roſe, and at nine o'clock had half an inch of altitude beyond the mark. By this means my obſervation at that hour was loſt. By raiſing another gate the water was reduced to its former altitude, and by twelve o'clock the diſcharge of water was exactly equal to the current, and from that time to ſunriſe the altitude continued the ſame.

At twelve o'clock, and from that hour to three, the wheel made 17½ revolutions in a minute, the obſervations being often repeated without a ſenſible variation of reſults. Soon after three o'clock a ſmall acceleration was perceptible, but it did not amount to half a revolution, until about half paſt three, when the wheel made 18 revolutions in a minute, which accelerated movement continued till half paſt four, when being near ſunriſe, the obſervations were diſcontinued. During the laſt obſervations I perceived a very ſmall retardation of movement, but it did not amount to half a revolution. To prevent any difference of reſiſtance in the mill, not the ſlighteſt alteration was made in the elevation of the ſtone, or the quantity of wheat delivered from the hop-

 per,

per, from the beginning to the end of the obſervations.

I had not a barometer with me at the mill, but about eight o'clock on the following day the barometer ſtood about one twentieth of an inch higher than on the preceding evening. The thermometer fell during the night to 54°.

From this experiment it is obvious, that the weight of the atmoſphere could not be the ſole cauſe of the acceleration of the wheel. The acceleration at twelve o'clock was almoſt an *eleventh*; at a later hour a *ninth* of the whole movement. The increaſed gravity of the atmoſphere will not account for a tenth of the difference.

We muſt then reſort to other principles for a ſolution of the phenomenon. It is commonly ſuppoſed that water is a non-compreſſible ſubſtance, but this opinion has been juſtly queſtioned. However this may be, I have little heſitation in reſolving the phenomenon of the water-wheel into its increaſed elaſticity during the night. How, or why, the ſubduction of light and heat ſhould produce or increaſe this property in water I leave for electricians to determine. The effect cannot be aſcribed to the increaſed gravity of water during the night, for no ſuch increaſe is obſerved.

It is an obſervation of ſeamen, that ſhips make more way in the water by night than by day with the

the ſame force of wind. I ſhould expect that the moiſture on the ſails might, in a degree, contribute to this effect, but it muſt be recollected, that at ſea, there is little difference in the moiſture of the air by night and by day. Can the effect then be aſcribed to the cauſe that accelerates the movement of water-wheels by night, an increaſed elaſticity? If the gravity and denſity of water were augmented during the night, theſe would render the water more buoyant, but retard the motion of a ſhip, by increaſing the reſiſtance. We are therefore driven to the ſame hypotheſis, an increaſe of elaſticity, which renders water more buoyant when at reſt and more impreſſive when in motion, without an augmented denſity and weight. But I am not ſure that the moiſture of the air will not account for the whole effect.

If the elaſtic power of water is increaſed by the abſtraction of heat, does it not follow that this power muſt be greater as we recede from the equator? and of courſe, any given force applied to the water in different latitudes will occaſion a vibration of that fluid proportioned to its elaſticity. Hence, the ſmall tides within the tropics, where the heat is nearly uniform, and the high tides in the northern regions, where the vibrations in the temperature of the atmoſphere are more conſiderable. Yet facts do not permit us to aſcribe this elaſticity to cold. It is more probably owing to the quantity of electricity, or

to its peculiar combination with aërial ſubſtances, of which cold is the effect. Perhaps, the following obſervations will throw ſome light on this ſubject. Ariſtotle, and after him Pliny aſſerted that no animal dies, except during the ebb tide. "*Nullum animal niſi æſtu recedente expirare. Obſervatum id multum in Gallico oceano, et duntaxat in homine compertum.*" Pliny Nat. Hiſt. lib. ii. 98. "No animal dies, except during the receſs of the tide. This is particularly obſerved on the coaſt of Gaul, and is at leaſt true with reſpect to man."

The firſt part of this obſervation is probably too general, but modern facts confirm the aſſertion, within certain limitations. A late miniſter, at Barvie, in Scotland, contiguous to the German ſea, made a ſimilar remark after fifty years obſervation.

Sinclair, vol. iv. 240.

The reaſon why Pliny has ſpecified the coaſt of France as remarkable for the fact ſtated, is very obvious. France lies on the main ocean, and the time of high and low water is the true time. On the coaſt of Italy, where there are no tides, the obſervation could not be made, and if made by the time of ebb tide in rivers and bays, it would not be juſt.

Another remark made by phyſicians is, that, *cæteris paribus*, more perſons die during the latter

part of the night than at any other time in the ſolar day. This remark has not come to me from a ſufficient number of obſervations to command full belief, but it accords with a few obſervations of my own. If univerſally true, it would contradict, in part, the remark of Ariſtotle and Pliny, but it is poſſible both remarks may be true with certain limitations. The fact may be more obvious, when ebb tide happens between midnight and ſunriſe, and leſs ſo when flood tide happens at that period, that is, under the combined or ſeparate operation of the two cauſes.

Other facts lend their aid to ſupport the obſervation, that ſome eſſential change in the properties of the atmoſphere takes place in the latter part of the night. This is the time when all fevers remit or intermit. The exacerbations and paroxiſms of fever invade the patient during ſome part of the day, and ſubſide in the latter part of the following night.

Again, The chills that precede fevers uſually come on in the ſame part of the day, that is, between midnight and ſunriſe. This is remarkably the caſe with epidemic diſeaſes, as all phyſicians agree. The fact has been aſcribed to the debility induced by ſleep, but I ſuſpect it is owing to the b ility induced by the ſame change in the ſtimulant powers of the atmoſphere

which occaſions the other phenomena above mentioned.

It is obſervable alſo, that ſleep in the latter part of the night is more ſound than at other times, an effect, perhaps, of the ſame cauſe.

Lind obſerves, that in the Eaſt Indies patients generally expire at low water; the ſame fact is obſervable at the full moon, and convaleſcents uſually relapſe at theſe periods.

See his Treatiſe on the Diſeaſes of Hot Climates, p. 86.

From experience I can teſtify, that relapſes uſually occur at thoſe periods of the lunar month when changes of weather take place.

Ulloa was careful to note the time of the tide when earthquakes occurred in South America, and he found them invariably to happen at half ebb or half flood, never at high or low water.

Voyage, vol. ii. b. 7. ch. 7.

There are other periodical changes in the atmoſphere which deſerve notice. Great ſtorms of wind, ſnow, and rain, uſually begin, abate and ceaſe, at certain hours, viz. at ſix, nine, twelve and three o'clock, eſpecially at ſix and twelve. To this remark there are very few exceptions.

Experienced accoucheurs inform me, that in lingering caſes of child-bed illneſs paroxiſms of pain recur at the ſame hours.

What

What is ſtill more extraordinary, we are aſſured by unqueſtionable authority, that in volcanic eruptions the diſcharges are more violent at theſe hours than during the reſt of the day. Sir William Hamilton, in his excellent account of the great eruption of Veſuvius, in June 1794, has the following paſſage: "The fever of the mountain, as had been remarked in former erruptions, ſhewed itſelf to be, in ſome meaſure, periodical, and was generally moſt violent at the break of day, at noon, and at midnight."

Univerſal Magazine, for Auguſt, 1795.

Theſe are the hours when we obſerve the great changes in the atmoſphere and ſudden effects on the human body in diſeaſes. The break of day is preciſely the time when the water-wheel is moſt accelerated, when fevers remit or intermit, and when the patient, lingering under diſeaſe, ſuddenly yields and ſinks into his grave.

To what cauſe ſhall theſe effects be aſcribed? Not to lunar or ſolar attraction, in the uſual ſenſe of the word. Attraction is conſidered as a ſteady principle, operating uniformly under the ſame circumſtances, and therefore the attraction of the moon, whoſe poſition in regard to the earth is every day changed, cannot account for periodical phenomena at certain hours in the day. The influence of the ſun will better ſolve the phenomena; but how can the ſame principle,

attraction, operating by uniform laws, produce the ſame effects at two oppoſite hours, for inſtance at noon and at midnight, which certainly is the caſe in regard to the exacerbations of volcanic eruptions, as well as in regard to the commencement, abatement, and termination of ſtorms?

I do not know that any principle yet diſcovered will ſolve the difficulty. But the phenomena bear a greater analogy to the operations of electricity than to any other principle in nature hitherto diſcovered. It ſeems neceſſary to invite to our aid repulſion as well as attraction, producing in oppoſite points the ſame effects. The nature and operations of electricity are little underſtood, and probably will never be brought wholly within human comprehenſion.

I will cloſe this lengthy article by obſerving, that the phenomena of lunar and ſolar influence are ſo well underſtood and clearly proved as to juſtify, in our minds, the great attention which the ancients paid to the influence of the planets on this globe. If they went into one extreme, by aſcribing too much to that influence, the moderns have erred, on the other extreme, by holding their doctrines in contempt.

* The ſun is the great ſource of light, and his rays excite the heat which exiſts in and around the globe. It moves this univerſal principle, which conſtitutes the energy of the material ſyſtem, under the controul of infinite intelligence.

The

The moon is placed in the vicinity of the earth to give variety to the ſeaſons, and by acting on the elementary principle of heat ſhe occaſions the viciſſitudes of rain, ſnow, fair, calm and tempeſtuous weather. The changes which precede and produce theſe viciſſitudes appear to be variations in the combinations of heat or electricity, with the other elementary principles of the atmoſphere. Theſe modifications of the atmoſphere, without any acceſs of new matter, or diminution of its maſs, produce difference in its denſity, gravity, and elaſticity, with all their various effects on the animal and vegetable ſyſtems. Hence a mere modification, or new combination of electricity with vapour or other aërial ſubſtance, may increaſe or diminiſh its ſtimulus; during the day it may excite fever in the human body, during the night a ſubduction of excitement in the atmoſphere may induce debility, and favour the invaſion of diſeaſe and the approach of death. Theſe are mere hints and conjectures, intended to excite inveſtigation.

With reſpect to the ſuppoſed influence of comets on the elements of this globe, I would remark, that on the principles here ſuggeſted, that influence is very clearly proved and may be eaſily underſtood. The facts ſtated demonſtrate that the ſun and moon exert great powers on the globe, and the fact, that earthquakes moſtly happen in certain

certain positions of the moon, prove that the *medium* of her influence is the electric principle.

Now comets are known to be of various magnitudes. Some of them are as large as Venus, much larger than the moon, with highly electrified atmospheres, and sometimes approaching near to the earth. The comet of 1577 came within less than a million of miles distance.

Those comets which pass the system at an immense distance from the earth can have no great influence; but others, approaching near, produce tremendous effects. Hence, during their proximity to the earth, the number and violence of earthquakes and volcanic discharges; tempests, inundations from rains and extraordinary tides, and most sensible changes in the powers of animal and vegetable life. That such are the effects is proved, not only by the concurring opinions of all the ancient philosophers, who were accurate observers of nature, but by one uniform series of historical evidence, for more than two thousand years. On the principles of electricity, which is disturbed, attracted, repelled and modified in its combinations with other substances, by the approach of distant bodies; the solution of the phenomena is easy and philosophical.

On Electricity.

SOME modern philoſophers ſuppoſe that the earth contains vaſt quantities of fire, which is the ſource of the principal part of the heat on the earth, the cauſe of vegetation, of earthquakes, and volcanic eruptions, and of hot ſprings.

See Buffon and Darwin's Botanic Garden. Additional Notes, p. 145. New York Edition.

There are ſome reaſons to believe that particular parts of the earth abound with fire, or maſſes of burning lava. This opinion is ſupported by the iſſuing of ſmoke from the craters of certain volcanoes for years in ſucceſſion without any eruption of fire.

But the theory which aſcribes earthquakes to ſteam or vapour, appears to be very unſatisfactory. How can ſteam be collected within the bowels of the earth ſufficient to ſhake a continent of 3000 leagues in extent. If a great quantity of water ſhould by accident fall on a maſs of burning lava, the effect would not be a general equable ſhake or concuſſion over a whole quarter of the globe, which ſometimes happens in earthquakes; but a violent ſhock at the place of contact, and a diſrupture of the earth, by which

which the force of the ſteam would be ſuddenly diſcharged into the atmoſphere. This, however, is not the fact. Almoſt all earthquakes in North America are progreſſive, beginning in the interior of the country, and proceeding towards the ocean in a direction perpendicular to the line of ſhore; that is, from North Weſt to South Eaſt. Perhaps we can find a ſatisfactory ſolution of this phenomenon upon electrical principles; but no cauſe can be found in the known properties and effects of ſteam.

One of the arguments uſed to maintain the theory of ſteam, is derived from the known fact that ſprings and ſtreams are uſually exhauſted by extreme drought, ſome time antecedent to earthquakes and volcanic eruptions. But the fact, inſtead of ſupporting the theory, operates to deſtroy it.

The hypotheſis ſuppoſes, that, at certain times, the ſprings in the vicinity of burning lava deſcend and fall upon it; and the water being raiſed into ſteam, and extremely rarefied, expels the burning materials in volcanoes with great violence; and in earthquakes, the force of the ſteam alone aſcends and ſhakes the earth.

But why ſhould the water of the ſprings find paſſages to the lava at ſometimes and not at others? If the paſſages were always open, the water would always deſcend. If they are open at particular times only, there muſt be ſome ſub-

ſubterraneous force exerted to open them before the water comes in contact with the fire; the effect then, or diſrupture, muſt take place in a certain degree before the ſuppoſed cauſe can operate. Conſequently the force exiſts anterior to the diſrupture which brings the water in contact with the fire. This concluſion ſuperſedes the uſe of vapour.

But by what magic does it happen, that all the ſprings and rivers in the neighbourhood of a volcano, for inſtance, diſappear about the ſame time? By what mutual conſent can this remarkable phenomenon be produced? And why, after the eruption, do all the ſprings and rivers reſume their former channels? Is it poſſible to ſuppoſe, thouſands of paſſages, ſcattered over many leagues of earth, to be all opened at once to convey ſubterranean ſprings to a particular place a few months anterior to an eruption of fire; and after the eruption, to be all cloſed at once, and the water compelled to run in its former channels? Yet all this muſt be admitted on the theory of ſteam.

That large volumes of water are ſometimes thrown into the baſons of volcanic mountains and ejected is true; but, in ſuch caſes, the diſrupture is occaſioned by a previous earthquake or force of fire, and the water is diſcharged in maſs; not in the form of vapour.

It

It is a fact authorized by all history and observation, that great earthquakes and volcanic eruptions are often, if not usually, preceded by severe and universal drought. This drought often extends over whole continents; and I find that the defects of water which occasion the terrible famines in Egypt, India, and China, of which we have many accounts, happen generally, (and I suspect always) a few months before and during some great discharges from volcanic mountains. I have certain evidence that this failure of rains and springs sometimes occurs ten months before the eruption. This was the fact in Bengal in 1769; and in America in 1762 and 1782. At other times, the drought happens during the eruption; and in some cases it is continued for two or three years, in which eruptions take place in different parts of the world.

The drought, on such occasions, is not occasioned solely by a failure of rain, but by the concurring influence of excessive evaporation. This fact is capable of demonstration. Sir William Hamilton, Univ. Mag. August 1795, in his account of the eruption of Vesuvius in 1794, informs us, that some days previous to the discharge, the great fountain at Torre del Greco began to decrease, so that the corn-mill worked by it moved slowly. In the wells of the town the water fell, and it was necessary to lengthen the ropes daily. Some wells became quite dry.

In

In a vineyard, near the town, ſome perſons were alarmed eight days before the eruption by a ſudden puff of ſmoke and exploſion from the earth.

It is recorded, that Pherycides foretold an earthquake in Greece from the ſudden failure of water in a well. Theſe facts indicate unuſual evaporation.

It is obſervable alſo, that the exhauſtion of water extends in ſuch caſes to a greater depth than uſual. The earth, below the uſual influence of the ſun's heat and of rains, loſes its natural moiſture. Such probably was the caſe in 1782, when the cedar ſwamps in New Jerſey took fire and burnt to the depth of many feet. And this is probably what Livy meant, when, in ſpeaking of the terrible drought in Rome before the great eruption of Etna, B. C. 426, he uſes the words "*ingenito humore egens*;" a failure of native moiſture.

In the vicinity of volcanoes, this evaporation may be accounted for on the principle of ſubterranean heat, which is ſenſibly increaſed ſome time before an eruption. But this ſolution cannot apply to countries a thouſand leagues diſtant, which ſuffer extreme evaporation at the ſame time.

There appears to be no way to account for the phenomenon but by the great principle of action, *electricity*. Indeed the diſcovery of the fact, that moſt earthquakes happen under particular phaſes

luminous appearances in the heavens, with extraordinary tempests and hail, are evidences of the same fact.

The idea that the heat which we experience exists in and about the globe, is, undoubtedly, well-founded. The sun is probably the great electric of the system, which excites into action the heat of the atmosphere and the earth; but there is no reason to believe that heat is principally derived from that body. The solar rays constitute a very small part of the heat of the earth; but they excite it by the rapidity of their motions, or by decomposing that which exists in the air and earth.

Hence there appears to be little foundation for the opinion, that the inferior planets, which are nearest to the sun, have more heat than Saturn and Jupiter. If heat is diminished in the ratio of the squares of the distances from the sun, it is on the principle that heat consists in solar rays; but this is a very questionable doctrine. Light is a substance, but does not necessarily contain heat; at least not any that is perceptible.

In 1771 a meteor, and then commenced influenza and measles. In 1775 a meteor, and the cynanche maligna prevailed. In 1783 two meteors, and then commenced measles and scarlatina anginosa. In 1788 a meteor, and immediately began the measles. If these coincidences are all the work of chance, they are certainly a very singular kind of accidents. More facts and observations than I possess are necessary to settle this question.

It

It is probable, that if the ſolar rays falling on Saturn, are diminiſhed in number, according to the doctrine of diverging lines, that this defect is ſupplied by an increaſe of denſity or ſuſceptibility of excitement in the atmoſphere of that planet. The denſity and capacity of being excited may be in a direct proportion to the ſolid contents of the planet, or in a duplicate ratio to the diſtance. Hence the larger planets are placed at the greater diſtance. And on this principle there is no ground to calculate, as Newton has done, the extreme heat which comets acquire in their perihelium. No ſubſtance of which we have any knowledge, could ſuſtain the intenſity of heat which he has calculated the comet of 1680 muſt have received. It is more conſonant to the general arrangement of the univerſe, as far as our limited underſtandings can comprehend it, to ſuppoſe none of the great orbs that roll in infinite ſpace, are either over heated or over cooled. Every orb has probably its own fund of heat, and the capacity of being excited, ſuited to its place and deſtination. The planets, the comets in the parts of their trajectories moſt remote from the ſun, and even the ſun itſelf, may be inhabited *.

In

* I take this opportunity in diſcuſſing the queſtion concerning the origin of heat, to notice what philoſophers have ſaid on the ſubject of the internal heat of the earth. Darwin, in his Botanic Garden (Note 6.) alleges the earth, below

In a knowledge of mathematics, and the appli-cation of mathematical principles to the material syſtem,

below the depth of about ten feet, to be always of the ſame temperature, which is 48 degrees by Farenheit. He cites Dr. Franklin's obſervation, that ſpring water at Philadelphia is of 52 degrees, which, he ſuppoſes, a proof of internal heat from central fires. For as the climate of North America is colder than that of England, he could not account for the exceſs of heat in the water at Philadelphia, beyond that of England, but by preſuming it to be occaſioned by internal fires. Yet in another paſſage in Note 7, the author intimates that he had an idea of a difference of heat in different latitudes, derived from the action of the ſolar rays. Yet I cannot find any European author who appears to have had a correct idea of this ſubject; and Mr. Jefferſon, in his notes on Virginia, (Query 5.) has manifeſted his ignorance of it by a moſt egregious miſtake. Speaking of a cave in Frederick County, he informs us, that the thermometer, which ſtood at 50 degrees in the open air, roſe to 57 degrees in the cave. He then adds the following remark: "The uniform temperature of the cellars of the Obſervatory of Paris, which are 90 feet deep, and of *all ſubterranean cavities* of any depth, where no chemical agents may be ſuppoſed to produce a factitious heat, has been found to be 10 degrees of Reaumur, equal to 54 and a half of Farenheit. The temperature of the cave above-mentioned ſo nearly correſponds with this, that the difference may be aſcribed to a difference of inſtruments."

It ſeems a little ſtrange that ſo groſs an error ſhould have paſſed uncorrected till this late age, on a point of fact ſo eaſy to be aſcertained.

The truth is, the temperature of the earth, below the diurnal and annual influence of the ſolar rays, which may be perhaps 10 feet in ſolid earth, and 30 feet in open wells, is

ſyſtem, Newton is, and probably will be for ever, unrivalled. But modern philoſophers enjoy the benefit

is regulated by the proximity of place to the equator, ſubject to ſmall variations from the poſition of the place in regard to the ocean and the height of the land.

But what is remarkable, this temperature of the earth and water, in the interior of the globe, is preciſely the *mean temperature* of the climate in the place where the obſervation is made. Thus, let the higheſt and loweſt points be taken daily by any good inſtrument, and divide the ſum of all the obſervations by the number of days in the year, the quotient will be the mean temperature of the climate, and preciſely the temperature of the water, below the variations of heat and cold. If any difference ſhould be found, it muſt be owing to inaccuracy in the obſervations. It is more uſual to take three obſervations daily; at ſun-riſe, the coldeſt time in the day; at two or half after two P. M. the warmeſt time; and at ſun-ſet, which is found to be the mean temperature. By obſervations made in the city of New York for one year, I found the mean temperature to be 53 and a half; but this is one and a half degree too high, owing to an exceſs of heat *within the city*, beyond the general temperature of the climate. The air in a city cools leſs at night than in the country; and hence the morning obſervations were found to be too high. In many inſtances, ice as thick as glaſs was formed a mile from New York, when an accurate thermometer in the city fell no lower than 40 degrees. Hence the great error of determining the temperature of a climate, by obſervations made in a large city, which is often done in Europe.

The mean temperature of the climate in England is 48 degrees; that of Paris 54 and a half. This difference is owing to the inſular ſituation of England; the atmoſphere in the vicinity of large tracts of water being always more

 temperate

benefit of many discoveries made by experiments and by collections of facts, which give them an eminent

temperate than on continents at a distance from the sea or great lakes.

The following is the mean temperature of the climate of the respective places, ascertained by observations,

London, North Latitude,	51°.30	temperature	48°.
Paris - - - - -	48. 50	——	54½
Quebec - - -	46. 48	——	42
Rutland, Vermont -	43. 34	——	43½
Salem, Massachusetts -	42. 30	——	47
Hartford, Connecticut -	41. 44	——	49½
New York - - -	40. 42	——	52
Philadelphia - -	39. 56	——	52½
Virginia, Frederick -	39.	nearly	57
Charlestown, South Carolina	32. 44	——	66

Allowing a trifle for differences of instruments, this table presents to view the various mean temperatures of the climates mentioned.

From this table naturally arise two observations. First, the great difference between the climate in Europe and America, under the same parallels of latitude. Thus London, in 51 degrees north, has a mean temperature almost as mild as Hartford in 41. Paris, in the 49th degree, has a climate nearly as mild as the northern parts of Virginia in the 39th, and warmer than New York and Philadelphia in the 40th.

Again, we observe the great effect of the ocean upon the climate. Salem, in Massachusetts, is upon the sea shore; and Rutland, in Vermont, 50 or 60 leagues distant; and one degree of latitude difference in the position of the places; yet the climate at Rutland is three degrees and a half colder than at Salem. On the other hand, Quebec, remote from the

eminent advantage over the great astronomers of the last century. The ideas of Newton, in regard to the tails of comets, seem to have no just foundation, and to be utterly repugnant to his own principles of the powers of gravity and resistance. He supposed them to consist of vapour or smoke, repelled from the nucleus by the force of the sun's heat. He seems to have been aware of the objection to this theory, from the resistance that must be made to the ascent of the vapour by the celestial ether; and therefore supposes an extreme rarefaction to take place, which removes that resistance.

But whatever rarefaction may be supposed, still it will remain an incontrovertible principle in

the sea, though on a river, with three degrees difference of northern latitude, has a difference of only one and a half degree in climate.

To ascertain the mean temperature of any given place, it is only necessary to plunge a good thermometer into water, taken from a depth in which the temperature is uniform at all seasons of the year.

The mean temperature of water within the tropics is not exactly known, but it must be very near 80° by Farenheit.—Water drawn from a depth of 200 feet in the West Indies, is *cooled* by filtration in the air, above the earth, in those hot regions.

The difference in the temperature of Europe and America, under the same parallels, is nearly that of ten degrees of latitude.

See Holyoke's Register of the weather, Mem. Am. Acad. vol. ii. part 1. William's Hist. of Vermont.

 physics

physics, that no substance that has *gravity* can be supported but in a medium which has *more gravity*. The vapour supposed in the present case could not be maintained in straight lines, without medium of greater density to support it. Now, any medium capable of supporting vapour, must furnish great resistance and very much retard its velocity*.

With these known principles in view, let any man calculate the velocity of vapour, driven from the nucleus of a comet, necessary to preserve a direction nearly opposite to the sun, in its perihelion passage.

Comets enter the solar system in various directions; the planes of their orbits making various angles with that of the ecliptic. Their orbits are nearly elliptical, and the sun is in one of the foci of the ellipsis. By the universal law of planetary motion, according to which all revolving bodies describe equal areas in equal times, the motion of comets must be very rapid in their perihelion. The comet of 1770 was calculated to describe an arch of 50 degrees in 24 hours. This seems hardly credible; but many comets describe an

* I submit it to mathematicians whether, on Newton's own principles, an atmosphere of density sufficient to support a cannon ball, would not retard its velocity as much as the present atmosphere does a feather put in motion. If so, his rarefaction does not in the least aid the ascent of vapour from the body of a comet.

arch

arch of 180 degrees, a ſemicircle, in 30, 40, or 50 days.

The perihelion diſtances alſo of the various comets are very different, and ſo are the lengths of their tails; ſome of them extending a ſmall diſtance, and others to 60 and 80 millions of miles.

Suppoſe the perihelion diſtance to be 30 millions of miles, and the length of the coma to be 70 millions. In this caſe the extremity of the tail muſt be 100 millions of miles from the ſun. Now, either the vapour which is ſuppoſed to conſtitute the tail, muſt be ſhot from the nucleus with ſuch rapidity as to reach the extreme point of the coma in a few hours; that is, it muſt paſs through 70 millions of miles in a very ſhort time, to preſerve a direction nearly oppoſite to the ſun: or the whole coma muſt move forward with the nucleus. In the latter caſe, the extremity of the coma muſt paſs along the periphery of a circle*, whoſe radius is a line from that point to the ſun, or 100 millions of miles. Of courſe, while the comet deſcribes an arch equal to a ſemicircle, the extremity of the coma muſt paſs through the ſpace of 150 millions of miles. I believe no kind of vapour, of which we have any knowledge, could perform either of theſe journeys in the time

* The figure would not be a circle, but it is not material to the argument.

given.

given. On the other hand, that denſe gravitating ſubſtance would not have paſſed through the diſtance ſuppoſed, from the creation of the world to this time.

On ſubjects of this kind we cannot arrive at certainty. All we can do is, to reaſon from analogy and form probable conjectures. We know of no ſubſtance in creation capable of producing the phenomena of the comas of blazing ſtars, except electricity or light. No other ſpecies of matter paſſes with a rapidity that will ſolve the phenomenon of the length of the coma, preſerved in a direction oppoſite to the ſun. The theories of Kepler and Hamilton are more rational than that of Newton. The tails muſt conſiſt of electricity, repelled from the nucleus by the force of the ſun; or muſt be merely the rays of light, coloured by their paſſage through the comet's atmoſphere. Theſe hypotheſis may not ſolve *all* the phenomena; but they will account for the principal, and are repugnant to no philoſophical principles.

The curvature of the coma has been alleged as an objection to this hypotheſis. But in fact, this is a confirmatory argument in favour of it, for it is analogous to the curvatures formed by aſcending ſtreams of electricity in the lumen boreale; indeed, it ſeems to be a law of electricity to move in bending lines, and, for any thing that we know,

know, this phenomenon may refult from the nature of that fpecies of matter, and be independent of refiftance.

In regard to the tranfparency of the tail, it refembles alfo the lumen boreale. Through both of thefe luminous appearances the ftars fhine with undiminifhed luftre; but vapour, however rare, would refract their light, and, in a certain degree, interrupt our vifion.

An Effay on Comets by Andrew Oliver, publifhed 1772, afcribes the tails of comets to air extremely dilated and repelled from the nucleus by the power of the fun; but this hypothefis is liable to all the objections ftated againft the theory of Newton.

My own opinion refpecting the material fyftem is this, that an atmofphere, the bafis of which is electricity, fills infinite fpace, and involves in its bofom all the folid orbs which fhine in the celeftial regions. This may be denominated the *mundane atmofphere*. My hypothefis refts on the following reafons.

Firft, The large meteors or globes of fire are formed in regions far beyond the limit affigned to the earth's atmofphere. Their altitudes vary from 40 to 80 miles. At the height of 80 miles, then, there muft be the matter of an atmofphere capable of generating globes of fire of half a mile in diameter; and of communicating founds as full

and

and diſtinct as the air near the earth, for the explosion of one of thoſe globes reſembles thunder.

Secondly, The lumen boreale has been often calculated to be viſible at an elevation of 7 or 800 miles. I do not rely on the accuracy of theſe calculations, on account of the difficulties attending them. In ſome inſtances, we are very certain that this light exiſts in the regions of the higher clouds.

Thirdly, The tails of comets muſt be matter, or depend on matter for their colouring by which they become viſible. In either caſe we have evidence nearly amounting to demonſtration, that a material atmoſphere fills the boundleſs regions of ſpace.

Fourthly, But an argument of ſtill more weight in my mind, is one drawn from the neceſſity of ſuch an atmoſphere, as the medium of attraction and repulſion—the principles that connect and bind together the vaſt orbs that roll in ethereal regions. I can have no idea of ſuch an immenſe power exerted in an immenſe void or vacuum.

It ſeems probable, that the parts of our atmoſphere which conſtitute *weight*, and influence the barometer, are limited to the diſtance of a few miles from the earth. Water, for inſtance, is a ſubſtance deſtined to anſwer certain purpoſes on the globe, and is probably confined to its neighbourhood.

But

But the principle of electricity may be, and undoubtedly is, a non-gravitating and permanently elaſtic ſubſtance. This may be diffuſed through infinite ſpace, and, by its amazing elaſticity, may be capable of communicating motion or force from planet to planet, with the rapidity of light.

Newton ſuppoſed infinite ſpace to be filled with a ſubtle ſubſtance which he called *ether*. Had this great man been acquainted with the laws of electricity diſcovered ſince his days, he probably would have exchanged the term *ether* for *electricity*.

By means of this powerful principle the planets all influence each other, and become the means of diverſifying each other's ſeaſons, ſometimes by attracting, ſometimes by repelling, and ſometimes diſturbing the proportions of this ſubſtance, or influencing its mechanical laws, by which it is combined or decompoſed with other atmoſpheric ſubſtances.

Hence we may account for the frequency of earthquakes, volcanic eruptions, and violent tempeſts, under particular phaſes of the moon, and eſpecially during the proximity of comets. The electrical matter accumulated in the earth by its own laws, or by reaſon of an unuſual demand *ab extra*, may, during the approach of theſe orbs, be ſuddenly called into action, and occaſion extraordinary tumult in the atmoſphere.

Perhaps

Perhaps alſo we may, in this hypotheſis, find a ſolution of the phenomenon, ſo intereſting to man, and ſo myſterious, why the approach of comets never fails to be attended with epidemic diſeaſes. The fact, in regard to comets which come near the earth, is unqueſtionable; and it is equally certain that earthquakes, volcanic eruptions, meteors, and many other electrical phenomena, are, at ſuch times, more numerous and violent than at other times.

Now it is proved by experiments, that the fibres of living animals are the moſt perfect conductors of electricity, while the integuments which cover them are non-conductors. A conſequence of theſe principles muſt be, that in all the motions or operations of electricity in the atmoſphere, the nerves muſt be the principal ſubjects of its influence. Hence if the atmoſphere is, at times, electrified beyond the degree which is uſual, and neceſſary to preſerve the body in a due ſtate of excitement, the nerves muſt be too highly excited, and under a continued operation of undue ſtimulus, become extremely irritable, and ſubject to debility. Shall we not find, in this hypotheſis, a rational ſolution of the phenomenon which has puzzled medical men, the exceſſive irritability of the nervous ſyſtem, in times of epidemic diſeaſes, which facilitates the invaſion of fever? Shall we not account for the eruptive diſeaſes which always precede peſtilential epidemics, on the principle

ciple of the great debility of the extreme veſſels, induced by the weakneſs of the nerves which ſpread over the human body near the ſurface; by which means thoſe veſſels are rendered incapable of performing their uſual ſecretions? Shall we not be able to account for the remarkable coincidences in time between the influenza, and unuſual electrical phenomena, as volcanic eruptions and earthquakes? May we not account for epidemic meaſles, in thoſe years when the atmoſphere ſhows evidences of high electrification? And will not this principle explain the diſeaſes among animals, the defect of vegetation, and the extraordinary generation of inſects, during peſtilence? It is well known that vegetation may be greatly accelerated by artificial electricity. Is this effect produced by what is called *excitement?* And if ſo, how do we know that a ſimilar power, operating on the elements, may not call into exiſtence innumerable inſects? To what other principle ſhall we aſcribe the *unuſual ſize* of common inſects, when they precede and accompany peſtilence, a fact well atteſted? There muſt be a cauſe for theſe phenomena; and where ſhall we find it, but in the univerſal principle of excitement?

It is now agreed among philoſophers, that electricity is the immediate agent in the formation of rain, ſnow, and hail. In confirmation of this theory, my enquiries into the cauſe of epidemic

diseases have led to a discovery, that those years when volcanoes discharge great quantities of fire and lava, including some months before and after the discharges, are, by a great difference, most productive of hail. Hence the immense damage done by hail-storms in those seasons which are excessively dry and hot; these years being closely attendant on volcanic eruptions. The theory which ascribes hail to extreme cold is defective. We know that pieces of ice of three, six, and even nine inches in circumference, sometimes fall in hail-storms. By the laws of gravity, a hail-stone must begin to fall as soon as it begins to be formed; and as it requires but a few seconds to descend, it is easy to conceive that mere cold cannot occasion a congelation rapid enough to form pieces of ice of half a pound weight. The process is electrical, and almost instantaneous; and we know that real snow may be artificially and instantly produced by means of condensed air and electricity. Hence we are led to the causes which connect severe winters with volcanic eruptions; and we derive the extreme heat of summers and cold of winters, which so generally accompany pestilence, from the same cause, a super-abundance of electricity.

Hence we are led also to the cause of the apoplexies, lethargies, and eruptive diseases, which almost uniformly follow great volcanic discharges and earthquakes in Italy. The system, and especially

cially the nerves, are exceſſively excited, and loſe their energy.

It is on the ſame principle alſo that we explain the phenomenon of freezing, when the thermometer is above the uſual point of froſt. This has been obſerved near volcanic mountains, where the atmoſphere is highly charged with electricity. In 1730, Dr. Cyrillus found by a thermometer made by Haukſbee, that water, near Veſuvius, froze with the mercury ten degrees above the freezing point. Phil. Tranſ. No. 424. Bad. Mem. vol. ix. 299.

The nature of this element, electricity, is little underſtood. It is the modern opinion that heat and light are only modifications of the ſame element. This is analogous to what we know of water, which exiſts in the form of water, of viſible vapour and air.

It is ſuppoſed that electricity cannot be inſulated in the human body. But if it cannot be inſulated in the form of *electricity*, may it not in the form of *heat*, and thus be the direct cauſe or matter of inflammation? If it can be accumulated and inſulated in this form, may not conductors be formed to draw it off in the form of electricity? Mr. Vinal relates, that he ſpeedily removed local inflammation occaſioned by a burn and ſcald, by the application of a negatively charged electrical machine.

Mem. Amer. Acad. vol. ii. 144.

Should this doctrine be well founded, the ſucceſs of metallic points in removing topical inflammation will be explained and eſtabliſhed.

The proofs of the altitude of the atmoſphere, from the power of refracting light, are now known to be fallacious. No man will ſuppoſe the atmoſphere to be leſs elevated in the equatorial regions than in the polar circles; yet the duration of twilight under the equator, being leſs than in places remote from it, proves that the power of refraction will not determine the height of the atmoſphere. The power of refraction is in a direct ratio to the diminution of heat, or increaſe of cold, in the atmoſphere, or perhaps to the increaſe of electricity.

Nor will it be correct to ſay that the power of refraction depends on the denſity of the atmoſphere, unleſs denſity can exiſt independent of gravity. The atmoſphere in the polar and temperate regions raiſes the barometer no higher than under the equator; nor is the mercury in barometers generally higher in winter, when the thermometer, by Farenheit's ſcale, is 10 degrees under cypher, than in ſummer, when it is at 98°, the temperature of blood-heat.

If denſity implies or involves in it gravity, then the atmoſphere at the equator is as denſe as in any diſtant latitude; for the barometer is as high in one as in the other. But if the atmoſphere is as denſe and as heavy, *ceteris paribus*, in one lati-

latitude, as in another, then the power of refraction does not depend on denſity, for the powers of refraction, in different latitudes, are various.

It is indeed very queſtionable, whether denſity and gravity are the principles which wholly influence the barometer. The barometer falls as it is elevated above the ſurface of the earth, but the atmoſphere retains all its powers of ſuſtaining reſpiration and circulation at an altitude of 15,000 feet.

What are the aërial phenomena that attend a fall of the barometer? How can the weight of the maſs of air, ſurrounding the globe, be ſuddenly taken off, over a whole continent? What becomes of its gravity, and the principle of attraction on which it is ſuppoſed to depend? Are they removed, expelled, or ſuſpended?

I ſuſpect the theory which aſſigns to the barometer the province of determining the *gravity* of air is fundamentally defective; and that, inſtead of variations in its *weight*, we experience only variations in the combinations of its parts, which diverſify its elaſticity, and its operation on the barometer, as well as on the human body. When the atmoſphere is full of vapour the barometer uſually falls, and we feel a depreſſion of ſpirits. It can hardly be true, that the preſſure of the whole atmoſphere is leſs at ſuch a time than when the air is clear and the barometer high; for this vapour circulates near the earth, and the higher regions of the air are as clear and as pon-

 derous

derous as uſual. If the denſity of the air near the earth ſhould be leſſened, the conſequence muſt be the air, from higher regions, which retains its gravity, muſt ruſh in to ſupply the defect.

The only way to account for the variations of the barometer, appears to be on the principle before-mentioned. The air appears to be leſs elaſtic when the heat is combined with vapour, and the mercury falls. It ſeems neceſſary to take into view theſe conſiderations in order to ſolve the phenomena: The general preſſure of the atmoſphere, or gravity, which is probably uniform, together with the various changes in its elaſtic powers, which occaſion the vibrations in the barometer.

Every dairy woman knows that thunder and lightning will almoſt inſtantly coagulate milk; that is, when electricity is united with vapour, and paſſes, in a viſible form, from cloud to could, or between the clouds and the earth, *milk turns* or coagulates. So it does during a rainy day in ſummer, without thunder, with the thermometer at 64°, as I know, by obſervation. This condition of the atmoſphere, may be called its *decompounded* ſtate. The barometer falls, vapour becomes viſible, the functions of the body are languid, milk coagulates, objects contract mould, in ſhort, the atmoſphere is unelaſtic, and ill-fitted to maintain vigour in animal or vegetable bodies.

I have remarked in the preceding pages, that a peſtilential atmoſphere is not corrected or moved

by

by the force of wind—no tempeſt expelling an epidemic fever from a city, unleſs at the cloſe of the ſeaſon, and accompanied with heavy rains. How can we ſolve this difficulty, but upon the hypotheſis of an electrical atmoſphere which is ſtationary?

Dr. Franklin proved, that "an electrified cork ball, at the end of a ſilk thread, whirled never ſo rapidly through the air, for a length of time, loſt none of its electricity. He found alſo, by an experiment, that, an electrical atmoſphere raiſed round a thick wire, inſerted in a phial of air, drives out none of the air, nor, on withdrawing that atmoſphere, would any air ruſh in."

On Electricity, London Ed. 97.

It is alſo proved, that a moſt violent blaſt of wind thrown acroſs a ſtream of electric matter, has not the leaſt effect upon it.

Theſe experiments prove, that air furniſhes no ſenſible reſiſtance to the motions of electricity, and that it exiſts in air without expanding or compreſſing it. In ſhort, it proves, that electricity acts entirely by its own laws, and is not controlled by the agitations of the air.

Will not theſe obſervations throw light on the fact of a ſtationary atmoſphere in caſes of peſtilential epidemics? Is not electricity the baſis of the common atmoſphere, and unmoveable by wind? And does not a peſtilential air conſiſt

partly in ſome combinations of this element with other aërial ſubſtances, which are not moved by wind? This is ſuggeſted merely for conſideration, for it appears, to me, improbable. Froſt deſtroys the peſtilential condition of the atmoſphere, and this is ſuppoſed to act upon the deleterious ſubſtances ariſing from the earth, or human body. Beſides, a peſtilential atmoſphere riſes but a few feet above the earth, which indicates that its pernicious qualities are denſe and gravitating ſubſtances.

Indeed, two cauſes ſeem to concur in the origin of peſtilential fevers; an electrical condition of the atmoſphere which renders the nervous ſyſtem extremely irritable, and the body of courſe prone to fever; and a collection of morbid matters ariſing from living* and dead animals, and putrifying vegetables. Wind may remove the latter cauſe, if acceſſible, which, however, is never the caſe in large cities, but cannot affect the influence of the former. Froſt has acceſs to all morbid cauſes and renders them inert; it alſo reduces the ſtimulus acting on the human body and renders it

* I mention the morbid matters from living bodies among the cauſes of peſtilence. I am perſuaded that perſpiration in cities furniſhes more poiſon than ſtreets and alleys. It fills all cloſe rooms, eſpecially bed-rooms, and in cloſe-built ſtreets it infects the very atmoſphere; and a more violent poiſon does not exiſt than perſpirable matter in a condenſed and fermenting ſtate. This can only be deſtroyed by a liberal uſe of water.

leſs irritable. But the electrical ſtimulus remains. Hence, although the progreſs of the fever is arreſted by cold, the type of it is viſible in the diſeaſes of the winter. The irritability of the ſyſtem, from electrical cauſes, ſtill remains, and gives to the fevers of winter the peculiar ſymptoms of peſtilential, or typhus, pleuriſy and peripneumony.

A remarkable property of electricity is to give polarity to the needle of a compaſs. A violent ſtroke of electricity deſtroyed the virtue of the load-ſtone, and reverſed the ends of the needle of the compaſs on board of Capt. Waddell's ſhip, in 1751; and a ſuitable diſcharge of that element will give polarity, like the magnet. Hence, it is concluded, that magnetiſm depends on electricity, but in what manner ſeems to be myſterious.

It is well known that the needle is ſubject to variations, which are different in different parts of the earth, and, in ſome degree, periodical. It has alſo a ſmall diurnal variation, receding from the eaſt, or *influence of the ſun*, from eight o'clock in the morning to two in the afternoon; and from the weſt, or the ſame influence, from two o'clock to nine, P.M. and during the night remaining ſtationary. Is not this owing to the repulſion of light and heat? If ſo, is there not an analogy between this diurnal variation and the phenomenon of polarity? If light and heat, falling on one ſide of the needle, repel it in a ſmall degree,

is it not rational to conclude that the equatorial heat ſhould repel the magnetic point, and direct it to the north? That is, the needle points towards that portion of the atmoſphere which is moſt perfectly electric.

It may be objected that the needle does not always direct itſelf to the ſame point: True, but there is ſome periodical revolution in the electricity of the terreſtrial regions; at leaſt the appearance and diſappearance of the *lumen boreale*, at certain periods, warrant this ſuggeſtion. It ſeems to be admitted, that there is a current of electricity from the equatorial regions towards the polar regions within the earth; and in the upper parts of the atmoſphere a current of the ſame element from the poles towards the equator. This idea is derived, in part, from the *lumen boreale*, and receives countenance from the fact, that a bar of iron, ſtanding directed towards the pole, will acquire polarity or magnetic properties; but directed towards other points in the heavens no ſuch effect is produced; indicating a ſtream of electricity paſſing through the bar, from the centre of the earth towards the pole, but not in any other direction.

Should this idea be well founded, and ſhould it be admitted that the lumen boreale is a current of electricity from the north to the ſouth, will not the periodical appearance and diſappearance of this light indicate a revolution in that current

about

about the axis of the earth, or, perhaps, an axis of its own? If ſo, on what laws does it depend, and how will it agree with the variations of the compaſs? It will be ſaid, that the variations are different in different places, and are not uniform in the ſame place.—True; but the general courſe of variations in the ſame place is tolerably uniform.

With reſpect to different degrees of variations in various places, I have one obſervation that is probably new. It is very probable, if not evident, that the *diſtributions* or *forces* of electricity are different in different quarters of the globe. I ſay *diſtributions* or *forces*; for a difference in the ſtate of exiſtence or modes of acting, will as well account for the phenomena as difference in quantity. My reaſons for this opinion are, that the barometer has different altitudes in different places at the ſame time. The mean altitude for a month or a year in places of the ſame elevation, is very various. Hence we conclude, that the weight of the atmoſphere cannot be the cauſe of theſe variations, for this, on a level of the ocean, muſt, on hydroſtatic principles, be every where the ſame. Yet the actual differences amount to one half or two thirds of an inch.

See Phil. Tranſ. No. 435. Bad. Mem. vol. x. 81.

It is eaſy to account for this difference of preſſure on the principle of different combinations of the

the electric principle with vapour or other local matter in the atmoſphere which may vary the *force* or elaſticity of the air; but I do not ſee how the *weight* of a fluid alone, whoſe preſſure muſt be equal, if of equal height and denſity, can account for theſe differences. It is utterly repugnant to all known principles of the equable preſſure of a gravitating fluid, to ſuppoſe a mere change in the form or compoſition of that fluid ſhould alter the abſolute weight. Water admits none of theſe varieties, being always of equal denſity and gravity at equal altitudes.

On the ſame principle of a difference of preſſure or elaſticity in air and water, without a change of weight, perhaps we may account for the very different elevations of the tide in different places, and, in ſome inſtances, in the ſame latitude. Is it not rational to conclude that the electricity is various in its combinations or quantity in different places, according to the heat of the climate, the neighbourhood of land and high mountains, or perhaps to the ſeats of volcanoes? The fact, that tides do not riſe as high on the main ocean as near land, ſeems to countenance this idea. It ſeems to indicate, that the medium by which the moon influences the water, has different powers near the land, and at a great diſtance.

Another fact that ſeems to favour the hypotheſis that electricity is the inſtrument of tides, is the great irregularity of tides. In many inſtances

ſtances there have been preternatural ebbings and flowings of the tide; ſome times the river Thames, for inſtance, has been left almoſt dry for many hours, when there has been neither wind nor earthquake to account for the phenomenon.* Theſe

* A receſs of this kind is mentioned in 1114, when the Thames for the whole day, on the 15th of October, was ſo low, that children waded over between the Tower and London bridge. In 1247 there was a ceſſation of the flowing of the tides for three months, before a ſevere earthquake. See Short, vol. ii. 145. I ſhould not be inclined to credit theſe relations if modern obſervations did not ſerve to confirm them. On the 11th of March, 1785, and 25th of January, 1787, the Tiviot, a large river in the ſouth of Scotland, receded and left its channel dry, in the former inſtance *two hours*, and in the latter *four*. No convulſion of the earth was known in that neighbourhood, nor within two or three weeks of the firſt inſtance. An earthquake happened on the 26th of January, the day *after* the ſecond inſtance, but could not be the cauſe. A ſimilar receſs happened on the day of the earthquake in the river Clyde.

On the 12th of September, 1784, in perfectly calm weather, the water in the Loch Tay, in Scotland, ſuddenly ebbed 300 feet and left the channel dry, then flowed again, and thus alternately roſe and fell for two hours. The ſame phenomenon, in a leſs degree, occurred in ſeveral ſucceeding days. Sinclair, vol. vi. 624.

The facts related of the ſea and rivers in Holland on the day, but not at the hour, of the earthquake at Liſbon, in 1755, where ſhips ſnapped their cables, and water daſhed over the ſides of veſſels, without the leaſt ſenſible motion of the earth, are ſtrong proofs of the ſame inſenſible but immenſely powerful action of the electricity of the globe. The ſwelling

These irregularities have invariably happened in years which have been remarkable for electrical phenomena. To this point I have paid particular attention. They are not always attendant on earthquakes or volcanic eruptions, but they occur in the same year or near the same period; evidencing that when those visible discharges take place, insensible discharges take place in remote countries, and on the opposite side of the globe.

Should it be admitted that electricity may be unequally distributed or operate with different

swelling of the ocean in the time of earthquakes is not so much owing to the rising of the earth beneath, as to the force of electricity. The intumescence sometimes begins *before* the shock, as it does *before* hurricanes in the West Indies.

In Scotland, during the great earthquakes in Calabria, in 1782, the water in the lochs was agitated without any motion of the earth, and the mercury in the barometer fell within the tenth of an inch of the bottom of the scale. On the 12th of February, 1787, the barometer at Edinburgh fell nearly to the same point.

These phenomena can be resolved into no cause but some operation of electricity, and they add much weight to my suspicions, that tides are governed by some laws of electricity, which are influenced by the phases of the moon.

The great fall of the barometer in Scotland is a strong evidence that the same energetic principle governs that instrument. It is absurd to suppose the atmosphere could have lost such a portion of its weight. Indeed it is far from being impossible that the rise and fall of the barometer may be occasioned by the force of electricity acting on the quicksilver itself.

forces,

forces, in various places, according to its combinations with aërial ſubſtances at different times; we may find ſome probable cauſes of the great diverſity of diſeaſes in the ſame year, as well as of the different heights of the barometer. The ſtimulus applied to the human body may be different in various places, according to the predominant operation of one or more of the following cauſes.

I. Soil, which may affect the air in various ways.

II. Situation in regard to elevation, to water, hills, mountains, minerals, freſh air.

III. The population of places, and all the conſequent evils of noxious exhalations.

IV. The cultivation of a country which has a moſt ſalutary effect on the atmoſphere.

It is very certain that the condition of the atmoſphere is very different in places which appear to be equally favourable to health. Children and valetudinarians are very ſenſible of theſe differences. It is hardly poſſible to remove an indiſpoſed perſon a diſtance of five miles without a ſenſible effect on his health; he is better or worſe

worse in his new atmosphere. Under the combined operation of such various causes, we are not to be surprised at the irregularity in the appearance of autumnal and epidemic diseases.

FINIS.

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